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EDHEAD

The gaming divide.

What makes a game?

I ask this question because of a recent discussion on our website, surrounding the launch issues of Battlefield Bad Company 2. To summarise, at launch, the game's server browser was slow, prone to crashing, and the game seemed to have a broken PunkBuster install.

I thought this was pretty unacceptable, but one of the counter-arguments was that the browser issues were not 'part of the game'. Thus, my question.

Time was, you could answer that pretty simply, but in this more complex age of dedicated servers, stat-tracking, and even DRM, I think the components that make up a game have expanded exponentially.

Sure, you can say a game is the experience you have playing it, but I believe there's a lot more. There's server stability, for one, when it comes to online games, especially MMOs, and games like Bad Company 2 which require a slightly more complex setup.

DRM, especially when it ties into a game's save system (like in Silent Hunter V), is also now part of a gaming experience, as are systems like achievements or levelling. This gets more complex by another order of magnitude when all that is tracked off a publisher's server, and requires constant updating – again, like in Bad Company 2.

So, yeah these days a game really is much more than just the engine that runs it, and the way in which a gamer interacts with that engine. And this modern complexity of the gaming environment can really create a challenge for reviewers and games writers. Basically, we don't think the defense of 'But the game's really good when it works!' is much of a defense.

A car might be really good when it's on the road, but if it's constantly in the shop for repairs, that very limited amount of good behaviour is of little help.

So game makers? Please pay attention to every part of every system attached to your games. To make another, more traditional analogy, a chain is only as strong as its weakest link, and we'd hate to get all negative on a game just because some dev can't be arsed optimising some of their code.

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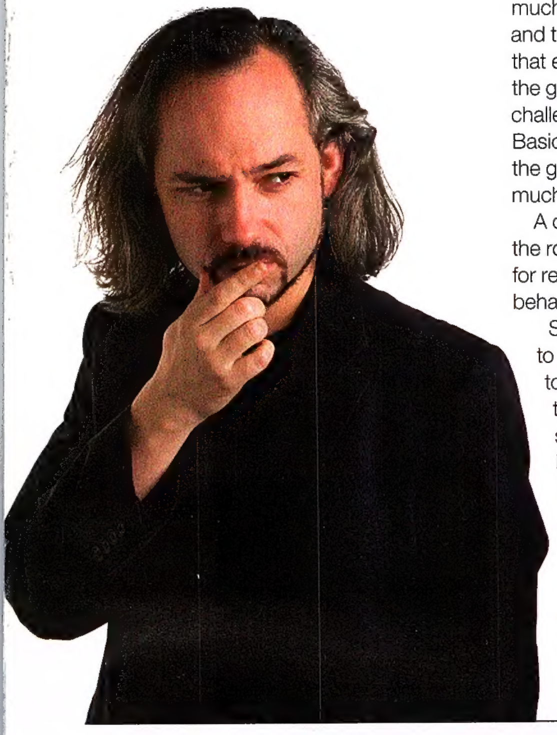

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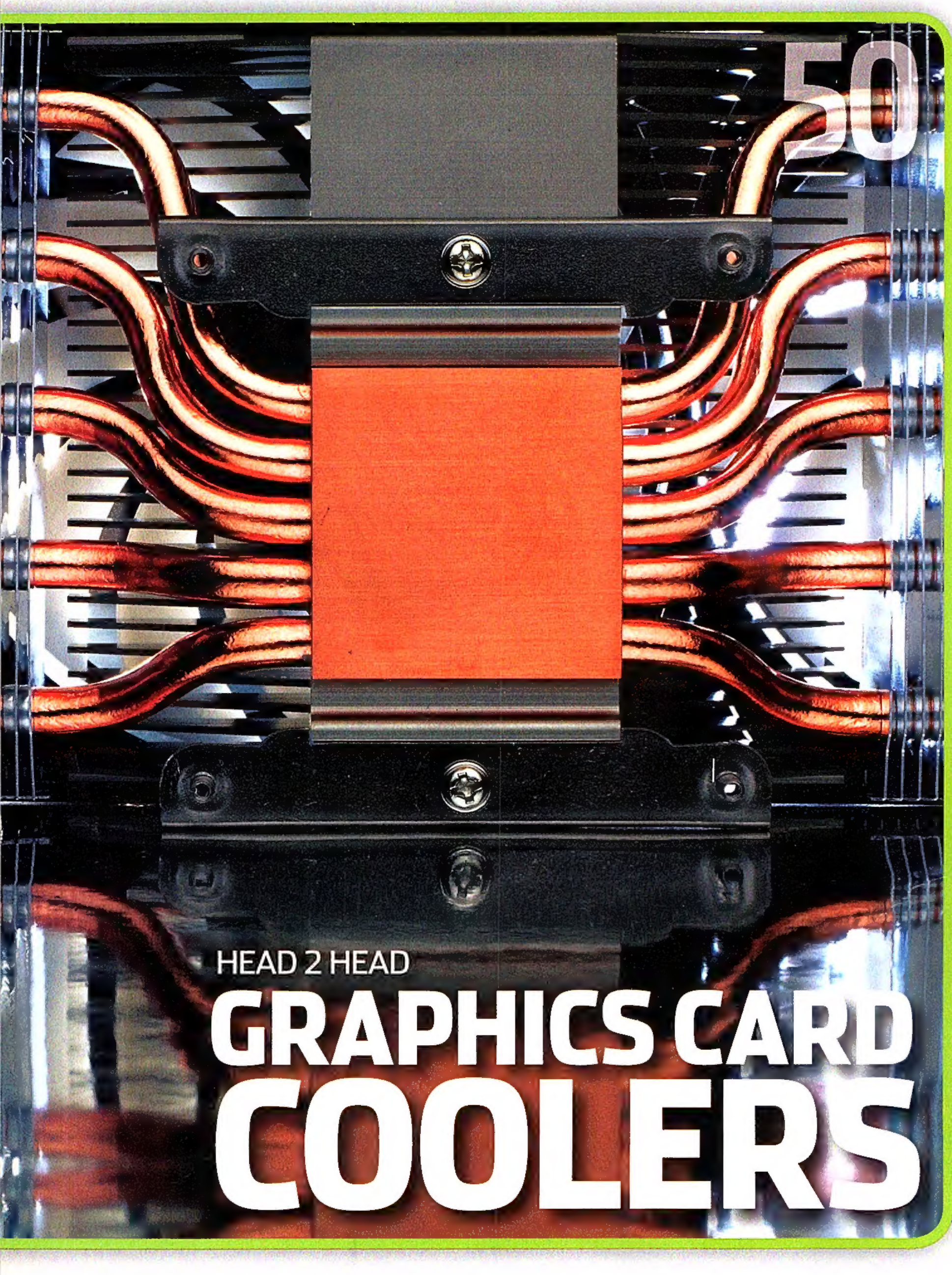

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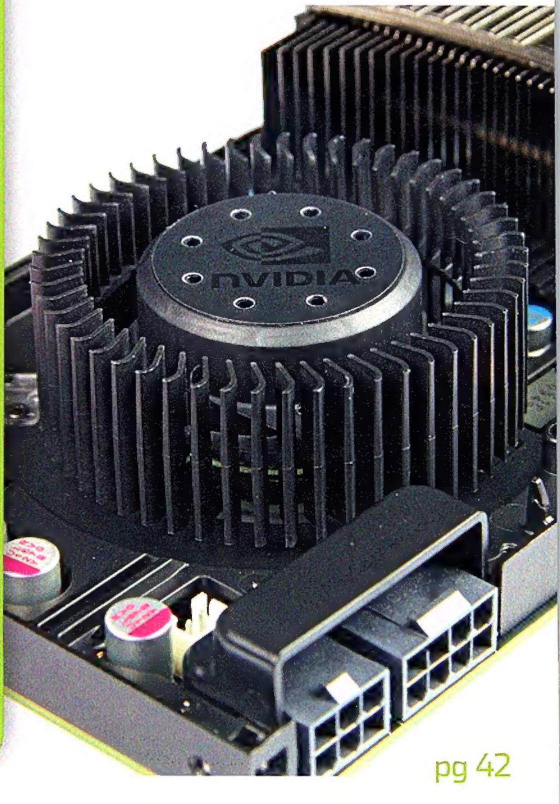

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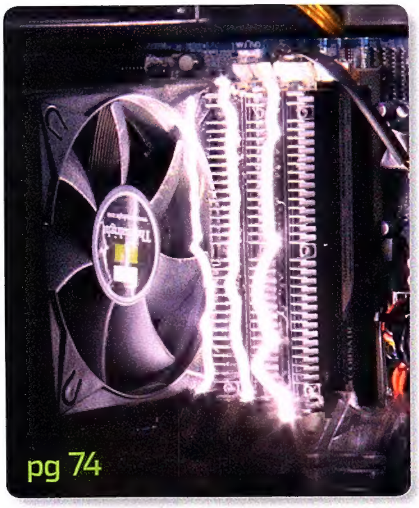
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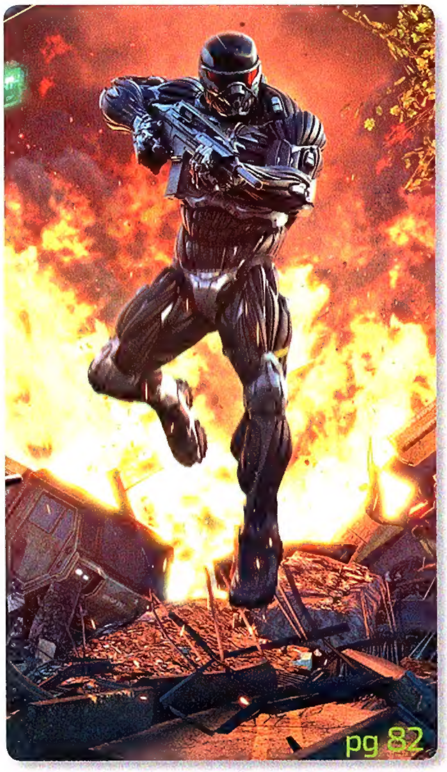
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F3AR is the latest entrant in the F.E.A.R series?

Proof that the more ridiculous the name, the uh, more ridiculous it gets.

F.E.A.R. was one of the most important games to hit the PC scene when it was released five years ago, bringing realistic AI to the table alongside some great visuals and honed gameplay (we even covered it in a hugely-indepth Engine Room).

It's time for another sequel; and the naming whizzes at Warner Bros seem pretty keen on calling the third instalment of the series the utterly ridiculous F3AR.

Not only is it hard to type (and even harder to say, "F-three-ear"?), but it also throws some new plot twists into the fear-filled mix; including a pregnant Alma, and a man who has clearly been shot through the head.

There's no hard release date for the game yet, and indeed we're sceptical that anyone on the planet will think this name is superawesome, but irrespective of the name it seems we can be pretty confident that a new one is coming.

SA Attorney General steps down

Everyone's favourite SA politician, Michael Atkinson, resigns from the front bench. Can has R18 now, plez?

Despite comfortably winning his seat in the weekend's recent state election, South Australian Attorney General Michael Atkinson announced recently he was quitting the front bench.

Atkinson is perhaps most well known for this staunch opposition to an Australian R18 rating for computer and console games, but he's also been embroiled over controversial and conservative views regarding censorship. He was forced to turn around a decision earlier this year demanding political bloggers use their real names.

Reactions have been typically effusive. On the website AdelaideNow, which broke the news, a poll asking "Are you happy that Michael Atkinson will no longer be South Australia's Attorney-General?" has so far been answered 'yes' by over 97 per cent of respondents.

On our own forums, the feelings are similarly strong, and largely unprintable. It's safe to say that few gamers are saddened by the news.

Nintendo's next-gen 3DS; 3D without glasses

Nintendo throws away dorky glasses with its next handheld system.

Nintendo has recently announced a brand-new entrant into the handheld console space, which they've dubbed the 3DS, with plans to bring 3D without the need for additional glasses.

The 3DS supposedly utilises a parallax barrier LCD manufactured by Sharp to generate the effect, a technology that uses different polarization of images to give slightly different viewpoints in-game.

A hugely technical look at the parallax barrier tech was posted up on Develop, which explains the technology thusly:

"A display that can be electrically switched between an autostereoscopic (no glasses) 3D mode and a full resolution 2D mode."

The 2D mode allows the user to enjoy the same performance as current displays, with the added advantage of 3D for enhanced reality and enjoyment.

In effect, this generates a 3D image that can be seen by the naked eye - though the drawbacks to this system require the user to be within a specific range of angles to the screen.

This shouldn't be much of a problem for the 3DS portable, since it'll be held in the hand at a comfortable distance, but it will be interesting to see the kind of graphical power needed to generate the effect (perhaps the Tegra rumour will see the light of day).

FROM ATOMIC ONLINE

It is TOTES that time of the month. No, not that one, the really cool one where we get to raise up one Atomican on our shoulders and cheer them until we're hoarse. Time to find some coolness on the forum and reward it with our respect, and a nice shiny mouse from Cyber Snipa and the fine folks at Digital World Warehouse.

So who's posting reigns supreme?!

Why, none other than **The Tick**, who bounds into action with some awesome Ubuntu shenanigans! **http://forums.atomicmpc.com.au/index.php?showtopic=29640&st=0&#entry596323**

But, of course, that's not all, and here's some secondary awesomeness you should point your browser at:

cmdwedge pops up out of the trench run to deliver this great guide to cool stuff in Melbourne: **http://forums.atomicmpc.com.au/index.php?showtopic=29653**

Macdude turns his impressive brainmeats to some interesting housing issues: **http://forums.atomicmpc.com.au/index.php?showtopic=29604**

And **Goth** gets into the climate change debate: **http://forums.atomicmpc.com.au/index.php?s=&showtopic=28503&view=findpost&p=574245**

So join me, folks, in congratulating our great posters for March!

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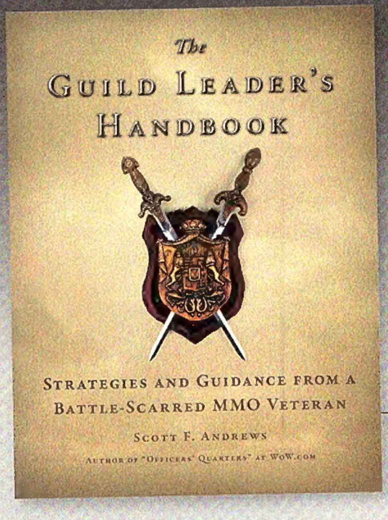
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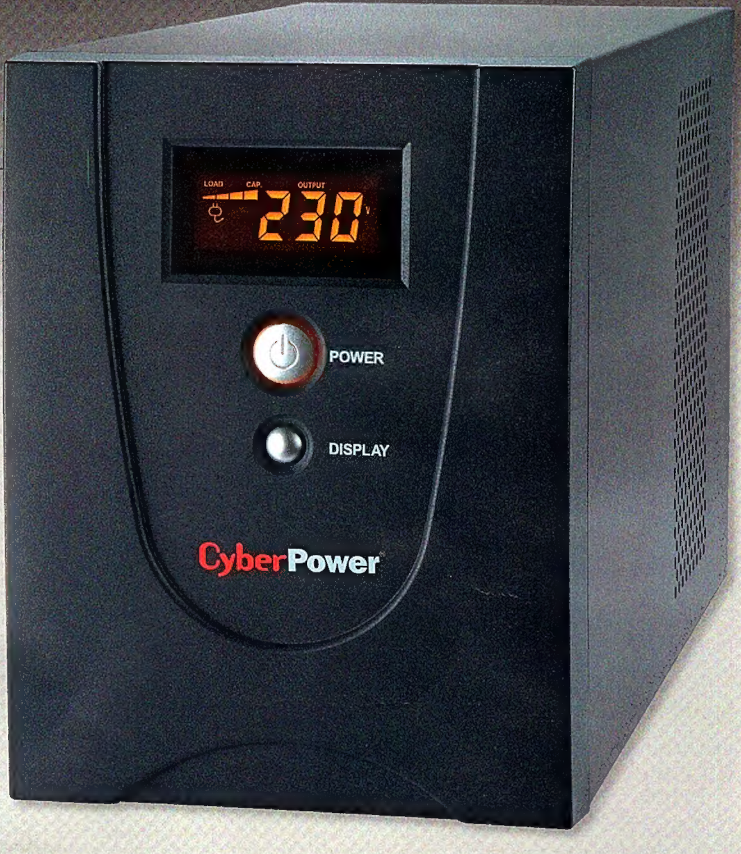

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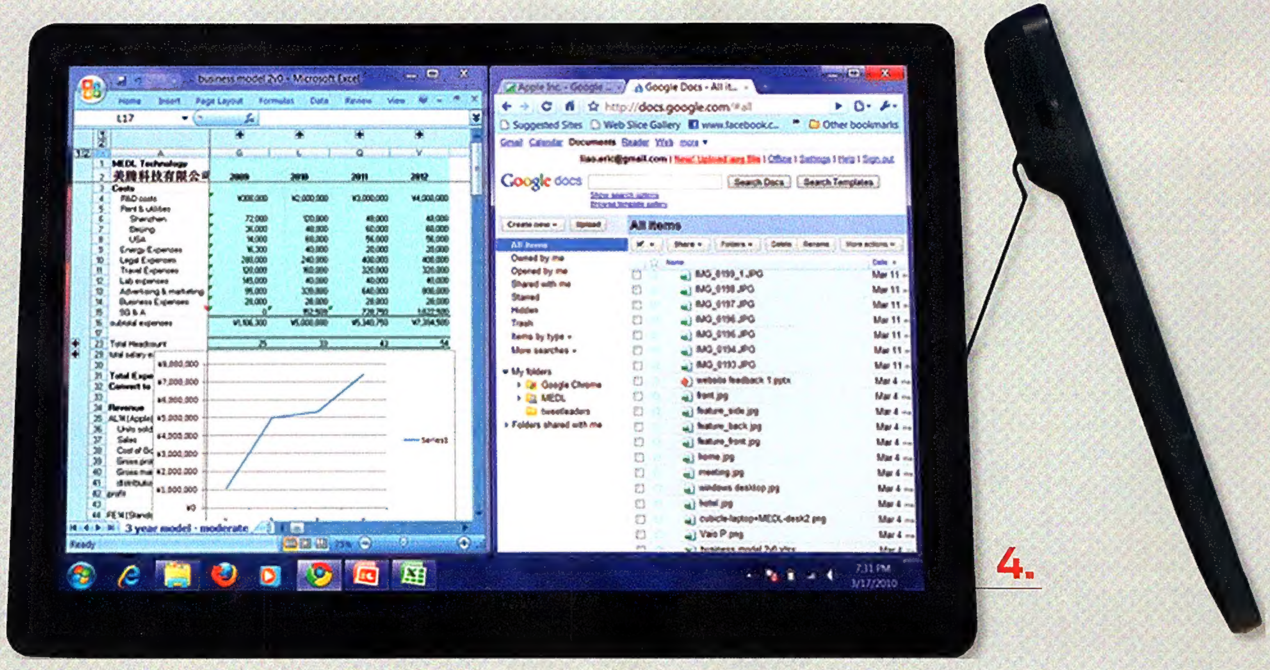

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1. The Guild Leaders' Handbook

Price $US24.95 **Website** www.nostarch.com

"When I started leading a guild, new guild leaders were very much on their own. I was unprepared for how challenging and complex the role would be," said author Scott F. Andrews. "I wrote The Guild Leader's Handbook to share the knowledge I've accumulated over the years through personal experience, research, and communicating with hundreds of players."

And you know, as dorky as a book on guild leadership sounds... we really want to read it!

2. Patriot Valkyrie

Price $200 **Website** www.patriotmemory.com

Of course, sometimes you need a lot more storage than a mere external drive, and you might want it permanently wired into your network for any machine to access. For that, you want Network Attached Storage – and Patriot's new Valkyrie is a great new example.

The Valkyrie offers large storage capacity (up to 4TB total), a compact design and a flexible interface for managing multiple users and access rights. Multimedia streaming is also possible with built-in UPnP and DNLA support and iTunes music server while also offering PC-less downloading via BitTorrent.

Of course, we expect you're only downloading legal files via torrent, right? Right.

3. CyberPower Value GP

Price $200 **Website** www.cpsww.com.au

Your average Atomican generally has a system that's super powerful, hand-built, and well-loved, but there's one thing a lot of us tend to ignore. A good 1200VA/720W UPS.

An uninterruptable power supply is useful for all sorts of things, and the CyberPower Value range adds another neat point – price! On top of being mightily affordable, it helps regulate power flow to your beast, and it can give you that vital few minutes of up time should your own power suddenly get cut off – like in a zombie apocalypse or something.

So don't let Zack get the better of you – get a UPS today, and protect your data from the undead horde!

4. The Panel

Price $TBC **Website** www.medltech.com

Sometimes the best ideas are the simplest, and that old adage certainly covers The Panel.

All it is is a 1280 x 800 LED backlit LCD touchscreen. Doesn't sound like much, but in terms of convenience, this is really up there.

It's designed to be an extra display for just about any device; it attaches via USB, and works with anything with a USB jack. Need a bit more screen real estate for your netbook? Done. Want to attach a screen to your Xbox? Sure. How about a portable display for browsing photos on your camera? Not a problem. Call it the world's first multi-purpose display – we call it pretty damn handy.

5. WD My Book 3.0

Price $249 **Website** www.westerndigital.com

Storage solutions are a dime a dozen these days, but the latest from Western Digital goes that extra yard to deliver something pretty neat.

The My Book 3.0 is your classic external drive, but it also comes with a USB 3.0 adapter card to allows fiendishly fast file transfers. Using that, on the right system you could transfer a 24GB HD film in just a shade under three minutes. Neato!

The My Book 3.0 is available in a 1TB model, and a 2TB one will be joining it shortly. And yes, that's a lot of pr0n.

6. Seahawk luggage

Price $349 **Website** www.ducti.com.au

Luggage? Surely not, Atomic, what are you thinking?

Well, it's simple: it's not the roomy size, the rugged construction, the hook belt for keeping suits and garments uncrushed, the internal zippers or the four wheels for smooth rolling about.

It's the camo – we're suckers for anything that comes in camouflage. (Though, making it harder to find something as important as your luggage might be a bit of a bad move – but it's cool, so we forgive it.)

3D Cinema

Jake Carroll finds the depth behind the screen, and explains how it all works.

Movies have a pretty powerful effect on popular culture. It's no surprise that the movie industry also has a tendency to drive technological innovation and create consumer demand. What we see in today's movies ends up feeding into the technology that we have sitting in our GPUs at Christmas time the next year. It probably isn't a coincidence that this year, the movie industry pushed 3D cinema back into our line of sight, and as a result, a torrent of 3D display panel technology, consumer video card driver enhancements and strange looking eyewear has popped up. This month, we're all about the third dimension. Hopefully it'll jump off the page at you.

3D Cinema was not the first instance of 3D entertainment, let alone technology in visualisation. The first such device was known as the Stereoscope and was invented by Sir Charles Wheatstone in 1840. The illusion of depth in a viewfinder was mainly used for entertainment purposes, but also for photogrammetry, a technique for measuring and determining the geometric properties of objects through photography.

3D viewing, and the perception of depth in real life, let alone a movie or image is a function of a wonderful ability that humans have known as binocular vision. Binocular vision does a few things for us.

1. If we somehow end up in a situation where we lose an eye – we've still got a spare to fall back on. Call it RAID1 for eyes.
2. Because we have two eyes independent of each other, with an ability to be controlled independently (although for the most part, this is subconscious), the light that bounces through to the back of our eye, and ends up as images to our brain, come at slightly different angles. This has purpose in depth of field (DOF) perception. Because of this built in ability, we can judge distances of objects in front of us, or estimate lengths of objects.
3. We're able to apply a technique to our vision known as binocular summation, meaning we can make out or determine faint objects at distance through physics internal to the eye, and infer about what we can see.

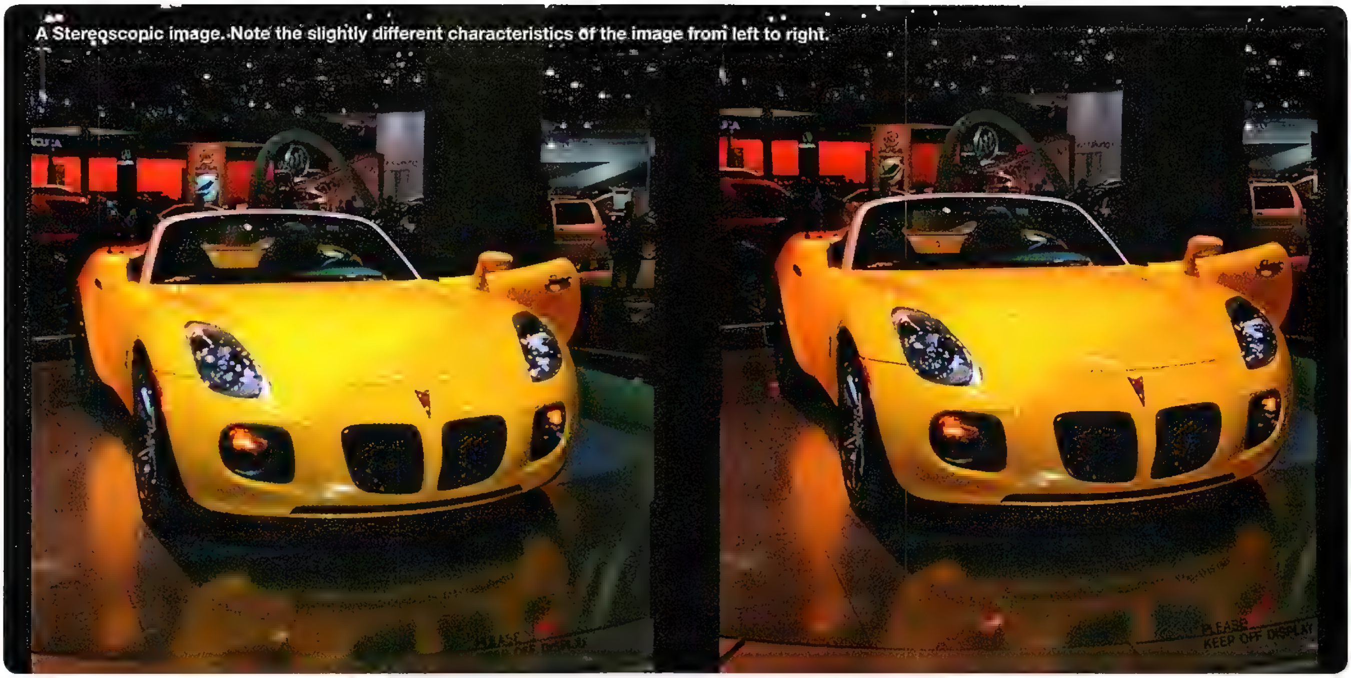
Evolution has given us a good thing as animals that evolved with more than one eye, Futurama aside, giving us plenty of flexibility.

The concept of stereo DOF or the illusion of a flat image being given depth is a result of binocular vision. When a user sees two images, each ever so slightly differing in angle or tilt, representing two different perspectives, with a slight deviation exactly equal to what the eyes naturally perceive in binocular vision, the impression of depth is given.

The images used are offset slightly in angle, colour, hue and contrast, so that there is an obviated differentiator between each eye. Without this differentiation, the 3D effect is not as obvious or strong. Additionally, the ability to perceive depth differs between every individual.

There are yet other methods of 3D viewing without the aid of external apparatus. One such method is known as 'random dot auto stereogram', which allows a viewer to perceive a 3D image by diverging their eyes whilst looking at a 2D image. Software can be used to achieve this, with a dithering and image dispersion

A Stereoscopic image viewer from 1893.


A Stereoscopic image. Note the slightly different characteristics of the image from left to right.

algorithm being used to inference a shape or cross sectional image into a seemingly random reoccurring pattern, which when viewed with diverged eyes meshes together to form a 3D relief.

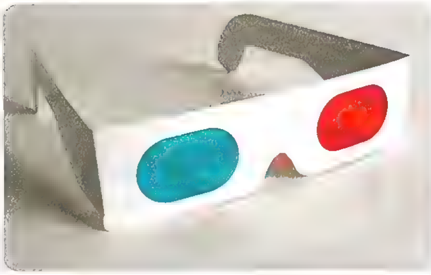
That is where the tale of holding up picture books and riding around on a Penny Farthing to go to the local stereoscope viewing centre ends, however.

Wearable stuff

Things get wearable from here on in. In the 1940s a film recorder known as the 'Stereo-Realist' system was created to put this stereoscopic effect into motion video. The idea was that the user would wear a stereoscopic set of lenses that showed an image through each piece of glass slightly offset. The technology didn't really work very well. People got motion sickness, headaches and generally, puke buckets were a standard issue in the few viewing locations that existed. Epic fail.

Generations of spectacles

Several technologies now exist beyond those things that required spew buckets and seasickness tablets. They can be generically categorised as active and passive. Active 3D glasses have some measure of communications or interaction with the display you are viewing, while passive technology simply sits on your head, and that is about it. No wires, cables or communications. Within active and passive type glasses, there are several different ways to create the illusion of 3D.



Active:

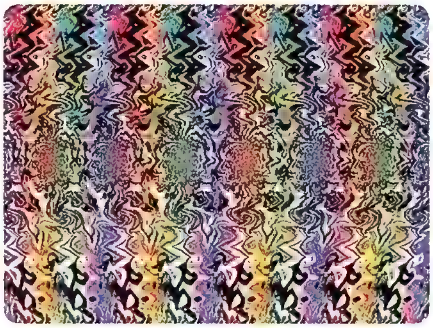
- LCD Shutter glasses.
- Head mounted display glasses.

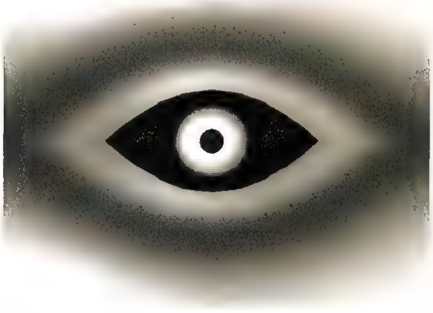
Passive:

- Linearly polarised glasses.
- Circularly polarised glasses.
- Infitec glasses.
- Complementary colour anaglyphs.

Active 3D technology is the most prevalent in home and scientific/visualisation markets, and seemingly will be the choice of the next generation 3D push for consumer dollars. With Nvidia and ATI actively putting investment and research into the technology, one can assume that it's set to become a mainstream sales channel. LCD shutter glasses are used in Nvidia's current Geforce 3D Vision kit, as well as the high-end professional-stereo products used in the Quadro line of GPUs. The technology works on the basis of alternate frame sequencing and Time Division Multiplexing (TDM). The LCD containing glass becomes dark when a current is applied, but when the current is taken away, it's transparent again. A timing signal is sent via IR, BlueTooth or Wireless 802.11x in synchronisation with a frame lock generator from the image being viewed on the display in front of the user. The glass darkens over one eye, then the other, in synchronisation with the frame rate of the display (generally 100Hz or above). The display itself provides a slightly different perspective for each eye, which is alternated one frame for the left eye, one frame for the right – shot or composited with two separate cameras. For this reason, films such as those destined for 3D are composited/rendered in 48 FPS, rather than the standard 24.

Similarly, in other active 3D systems, the head mounted LCD display close to the eyes, uses a combination of the binocular effect and alternate frame sequencing to achieve a 3D representation or sensation. The head mounted


Magic eye random dot auto stereoscopic image. Note the repeating pattern that seemingly doesn't have a discernable image embedded in it.


Diverging the eyes will reveal the shape used in inference by software in 3D.

The nVidia 3D Vision scenario consists of 3D LCD shutter glasses, 120Hz panel, 8 series or above GPU, and a newish system running Win 7 or Vista.

LCD however has been often associated with headaches and motion sickness.

Passive systems sound less cool (let's face it, nobody wants to be passive about anything these days. If we were more passive, there might be less war), but they have benefits and abilities that active systems do not.

Linearly polarised glasses act upon two images laid upon each other slightly offset or superimposed through orthogonal polarising filters in a projector. The glasses the viewer is wearing also contain orthogonal polarising filters. Because of this, and the angle at which the light from each image hits the lenses in the glasses, the viewer only sees one image per half of the glasses, and as a result formulates the now familiar binocular effect of depth.

... Infitec has been used in many 3D cinema installations as a valid and strong alternative to traditional anaglyphic methods...

The disadvantage here is that because linear polarisation works exclusively upon the angle of light entering an object, tilting the head or moving destroys the illusion.

Similarly, circularly polarising filters are worn and work in the same way as linearly polarising glasses, except that the viewer can tilt or move their head and the effect isn't compromised, as the angle of entry of light is curved around the lens. The most common and widely used 3D cinema system currently in use, RealD Cinema, employs the circularly polarising mechanism, oftentimes projecting a purely digital 4K (greater than 1080p, at 4096×3072) resolution film. The most recent wave of 3D films such as Avatar and Alice in Wonderland employ the RealD system.

Moving along, there are another complex sub-set of passive 3D viewing mechanisms, such as Infitec glasses that use interference filters in both the lenses of the glasses and the projector itself. A complex set of filters divide light into six bands of the spectrum, two in the red shift, two in the green shift and two in the blue shift. R1, G1, B1 get used for one eye, and R2, G2, B2 get used for the other. Because our eyes are insensitive to slight shifts between these parts of the spectrum (hence, the concept of RGB works in television to form realistic colour), we perceive full colour 3D. For this reason, Infitec has been used in many 3D cinema installations as a valid and strong alternative to traditional anaglyphic methods, being considered 'super-anaglyphic', as it uses considerably more complex spectral multiplexing technquies.

Finally, we arrive at what is most commonly referred to as 'those red and blue 3D glasses', better known as complementary colour anaglypic 3D. Going by other names, such as Anachrome Optical Diopter Glasses and films, the downsides to the technology are obviously the false-colour mechanism imposed. The upshot is the cost effective nature of this technology; however it's not very popular in the face of circularly polarising hardware, which can retain all colour information.

Display technology

Up to now, we've concerned ourselves with the bits you wear to create the illusion of depth. Now we'll look into the display technology itself.

Display mechanisms for 3D viewing come in three main forms today.

- Silver-screen.
- Wrap-around vis-walls.
- 120Hz+ displays.

The silver screen (actually known as a silver lenticular screen), which people oftentimes mistake for a standard cinema screen one might

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REPUBLIC OF GAMERS

find at Event Cinemas, Hoyts et al is actually metallic so as to have an accentuating effect upon the polarisation techniques used by several 3D technologies. The actual amount of light reflected from non-metallic screens varies with the directionality of polarisation and the angle of incidence. This isn't the case with a metallic screen, covered in something shiny. The RealD system, for example, depends upon maintaining polarisation of the light that hits both lenses in front of our eyes, so a higher reflectivity quotient means brighter, more significant amounts of light that come back at us. Unsurprisingly, the highly reflective screens are being installed more prevalently in mainstream cinemas as a result. All that is old, is new again.

Wrap around video walls are common in the bio-informatics, engineering and scientific visualisation world. Large wrap around walls, coated predominantly in white are presented in front of the user, who wears a pair of active glasses, while the wall is bombarded by multi-angle projectors. Projectors such as Barco's Galaxy NW-12 produce 1920x1200 @ 12,000 lumens, in active stereo.

By far the most exciting thing in 3D development, however, are the new 120Hz consumer panels hitting the home market. With Acer, Samsung and LG all pushing each other for a space in this market, there is some assurance that we'll see product development and improvement rapidly. In conjunction with shutter style active glasses, a 120Hz display such as the Samsung SyncMaster 2233RZ and an appropriate video driver, everything from games, to your desktop and movies, can effectively end up in 3D.

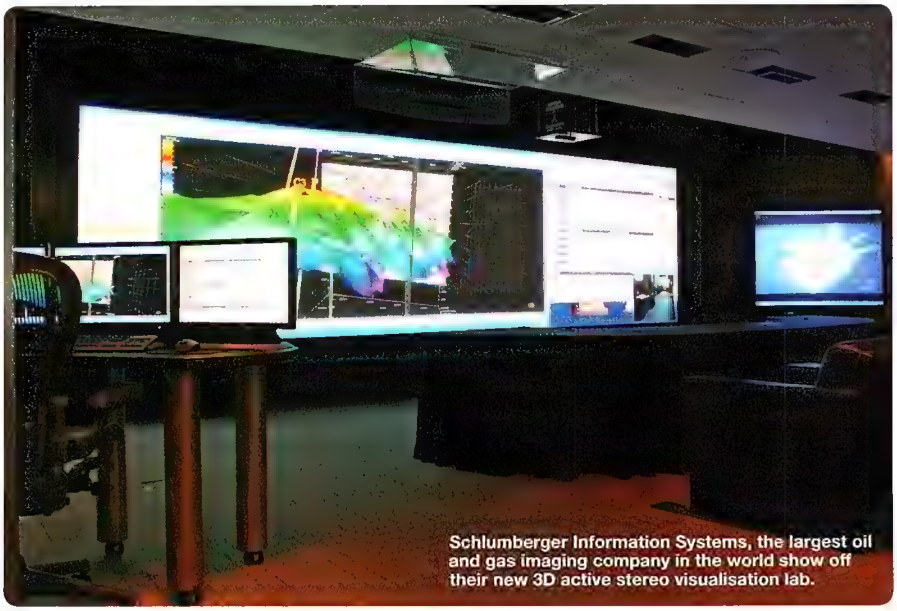
The last few months in cinema have changed what we perceive a cinema going experience to be.

Future sight

The future of 3D is, as some would have us believe, without glasses or odd eyeware. How exactly this will be achieved is a little up in the air still. The Fraunhofer Institute, in Germany (yup, the same guys that invented MP3), suggest they've got a way to do this. The group have created a screen with two small cameras that constantly monitor the motion paths and movement of a user's eyes, then, based upon the movements and directionality of the user's eyes, renders a 3D image on the screen in front of them, allowing manipulation of the image via a motion tracking air board. Samsung has also come up with a 3D LED eyeware-less solution, but it has many critics. AMD/ATI's EyeFinity 6 panel ultra thin display technology also looks set to implement an immersive 3D mechanism without glasses.

The biggest problem faced by 3D without glasses is the ability to actually make an image have depth in the autostereoscopic sense, but not pose a problem for the user standing infront of it. Autostereoscopic imaging such as Magic Eye in still images is something that requires a little concentration and eye muscle (conscious) manipulation to enjoy. Worse than this, autosteroscopic imaging and the occular techniques required to make it work are not completely accessible to all people. Some people just can't use Magic Eye for example.

The last few months in cinema have changed what we perceive a cinema going experience to be. 3D is no longer just about cool stuff that shoots by your shoulder, or deliberate objects poking out of the screen, but the subtlety and intelligence of giving the audience the chance to explore the foreground, background and visual splendour of something we'd anticipate seeing in real life. Until we can reach out and really touch the scene, as cool as 3D movies have become, the Atomic staff recommend real life for the time being.



Schlumberger Information Systems, the largest oil and gas imaging company in the world show off their new 3D active stereo visualisation lab.

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The mancave

Ashton Mills likes his personal space.

There are a number of rooms in my apartment. Technically, I own them all but in reality only one is mine. The rest, well, she has taken them, mastered them, and now holds dominion over them.

But not my domain. My sacred source, my fort of fortitude. My home.

The Mancave.

Oh, she looks longingly into it, almost forlorn, her eyes begging to come in and organise it, move things around, perhaps perchance to even dream of 'cleaning it up a bit'. But no! This room, my readers, is my domain. Here, my word holds sway.

Sometimes, to throw her off the scent, I will scatter something unimportant near the door that she may find and remove...

It is adorned with my hobbies, my books and my technology. My being. In one corner I have a draw full of hard drives so old they label '36 GB' like it's somehow a lot of space. In another corner, skyscrapers of magazines reach for skyward (Atomic mostly, but also APC and PC Authority among others). Near these rests an old friend: my trusty 19in Sony Trinitron 400PS CRT monitor, weighing every bit as much as the back-breaking heavy thing that it is. For some reason, I have a collection of ADSL2+ modems in yet another corner, while perched on a bookshelf sits an AOpen 440BX-based motherboard with Pentium III CPU still slotted in, casing removed, and strapped to four overclocking-sustaining fans.

One could reasonably question why I need some of this, and certainly she who cannot be named has asked as much. Granted, there are piles of 'stuff' here and there, cables and parts, old things and mysterious things. But their importance belies their seemingly messy nature. It's all part of the geek's domain, where my inner geek can run wild with abandon like Bender in a bar full of booze.

She doesn't understand why she can't 'play' in the mancave (an expression of, I think, an unhealthy passion to organise things). Why, I say? Because it is a dangerous land, and every piece of equipment has its place. If something gets moved, I won't know where to find it. Yes, that pile of motherboards serves a purpose, and no those papers can't be thrown out! That sock on the floor? Intentional too! It is a reminder, an object of memory, for something I have to do on my to do list. If only I could remember what that was now... But I digress.

Sometimes, to throw her off the scent, I will scatter something unimportant near the door that she may find and remove, giving her a sense of accomplishment that she has encroached a little in my domain. She does not know it is just there to satiate the beast.

Well, she does now. Dang.

But aside from the centerpiece, the beast PC and monitor upon which most time in the mancave is spent, why is it all important to me? Why must all these things form part of the mancave? I have no idea. They just do. Nuff' said. For a man's mancave is like Samson's hair, Frodo's ring, or the Emperor's Death Star. You just don't mess with it.

It's that one environment to tinker, explore, and play to the heart's content. Where you can be self expressed. Our partners may not understand our geekly abodes, but they can appreciate their value. She has, afterall, her own version of the escapist retreat.

Speaking of which I'm quite sure there are womcaves, er wocaves... um girlcaves (dig *up*, man! – ed) for the female geek. We're all the same, and I know that you know exactly where I'm coming from. So as you read this from your cave, look around, nod nonchalantly to yourself and smile: for it is a marvellous thing, your beacon of geekdom.

No, seriously, stay out of his cave.
amills@atomicmpc.com.au

Simply Fast: The New GIGABYTE P55A-series of Motherboards

The continual improvement of technologies and manufacturing processes has allowed modern PCs to evolve from cumbersome, micro chip-laden platforms with dedicated functionality to high performance, multi-function systems with limited numbers of highly integrated chips. Continuing in this trend, the introduction of the Intel® P55 chipset together with the LGA 1156 Core i7/Core i5 processors delivers advantages such as a smaller footprint with its new 2 chip platform, superfast integrated memory controllers in the processor, lower power consumption and higher performance.

Other exciting new developments include the launch of the media-rich Microsoft® Windows® 7 operating system while industry leaders such as NEC, Marvell and Seagate ready their cutting edge USB 3.0 and SATA Revision 3.0 technologies for accelerated management of media on the new operating system. As the leader in motherboard innovation, GIGABYTE quickly adopted these futuristic technologies with the new P55A-series of motherboards that feature USB 3.0, SATA Revision 3.0 (6Gbps) and a 3x USB power boost – essentially 333 onboard acceleration!

The GIGABYTE P55A-series delivers unparalleled performance with SuperSpeed USB 3.0 technologies from NEC and SATA Revision 3.0 technologies from Marvell mounted directly onboard; this is superior to a makeshift add-on card solution that could create a bottleneck at the PCI-E slot when 2 or more SATA 6Gbps devices are attached to it. GIGABYTE P55A motherboards also provide an unprecedented 3x USB power boost on all USB ports for even the most power hungry USB devices. There are also all the usual technologies from GIGABYTE that include Ultra Durable™ 3, AutoGreen, DES2 and GIGABYTE Smart 6 for easier and smarter PC system performance, power and security management.

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USB 3.0 – 10x Super Speed

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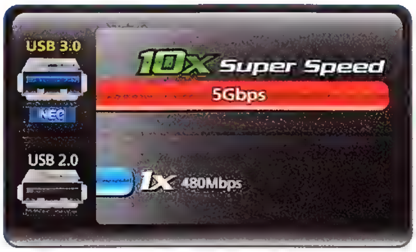
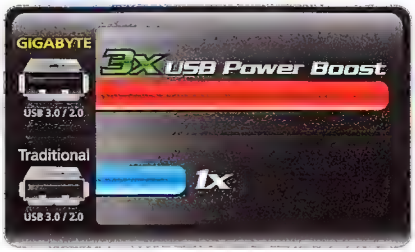
GIGABYTE P55A motherboards feature the next-generation SuperSpeed USB 3.0 interface from NEC that provides a 10x data transfer speed boost over USB 2.0. Data transfer between the PC and USB 3.0 devices is enhanced through dual-simplex transfer for simultaneous bi-directional data flow.



USB 3x Power Boost

Utmost compatibility with 3x USB power boost

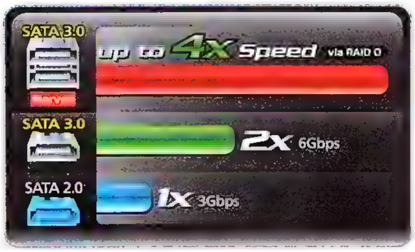
GIGABYTE P55A motherboards introduce a unique new USB power design that effectively triples the power output from all USB ports. The result is unequalled USB device stability due to sufficient power delivery from a single USB port. This also frees-up USB ports for additional USB devices.



SATA 3.0 – 4x Speed via RAID 0

World's First SATA Revision 3.0 solution provider from Marvell

The very latest advancement in storage technology is SATA Revision 3.0 that effectively doubles the data transfer speed compared to SATA 2.0. GIGABYTE is working closely with Marvell to introduce SATA 3.0 on the full range of P55A motherboards. When using RAID 0 (Striping) mode, SATA Revision 3.0 can enable a data transfer boost of up to 4x over SATA Revision 2.0.



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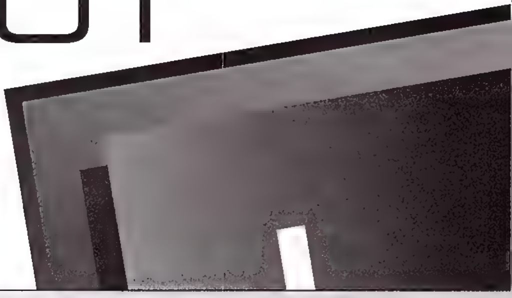

I/O OF THE MONTH

Lies, damned lies, and cheap-PSU specs

I Me and my friend were having this little debate the other day. He thinks that you need at least a 650W power supply to power an average gaming system. Apparently any 650W will do. He even picked out an A-Power 650W for me!

What do you actually need to power an average gaming system such as a Core i5, 4GB of RAM, 2 HDDs, Radeon 5770, etc?

My friend went so far as to take me to the school IT guys, and they mentioned that graphics cards can chew up to 300W of power! I understand that high-end GPUs (that I can't afford) are like that, but he thought that an average graphics card can need 300W too.

I know this probably has been asked a lot, but could you guys possibly restate some information about efficiency, 12V rails, amps and such just for them?

Jeremy Power
[possibly an assumed name!]

O There's no way to put a definite figure on the power consumption of an 'average gaming system', because there are many possible configurations for such a system.

A computer like the one you describe shouldn't be able to draw more than about 300 watts, no matter what you do to it. Maybe 400, if you really push for some overclocking records.

But that doesn't mean that a '300W' PSU will be able to power it. For three reasons.

One: The current draw of your computer on the different PSU rails probably won't perfectly match the current-rating division of those rails on the PSU. Modern PCs generally need a lot of amps on the 12V rail.

Two: Even high-quality PSUs aren't made to deliver something close to their maximum rating for long periods of time.

Three: Most PSUs are not high-quality PSUs. An awful lot of PSUs aren't even *fair*-quality; they can't deliver anything remotely like the wattage number on the sticker.

A decent '650-watt' PSU certainly should be more than enough for the Core i5 system you describe. An A-Power '650W' PSU might be OK, or might not; A-Power appear to be just one among many anonymous rebadge brands clustered at the front of the cheap-hardware phone-book.

There's a reason why one '650W' PSU costs $50 and another costs $200. The more expensive one will probably weigh a lot more, last rather longer, be made in a much more reputable factory, and be able to get a lot closer to its sticker capacity.

At the very bottom end of the market there are PSUs that come from the factory with no power rating sticker on them at all. The retailer just sticks a '400W' sticker on the box if he wants to sell it as a 400W PSU, or a '700W' sticker if he wants to make a bit more money. Your typical dirt-cheap allegedly-500W no-name PSU today can confidently be expected to be good for not much more than 250W, and even at that load level it'll probably only survive a few weeks.

Fortunately, magazines like Atomic and all of the major review sites are well aware of this problem, and do proper load tests. This makes it quite easy to find the PSUs with honest ratings.

I/O OTM

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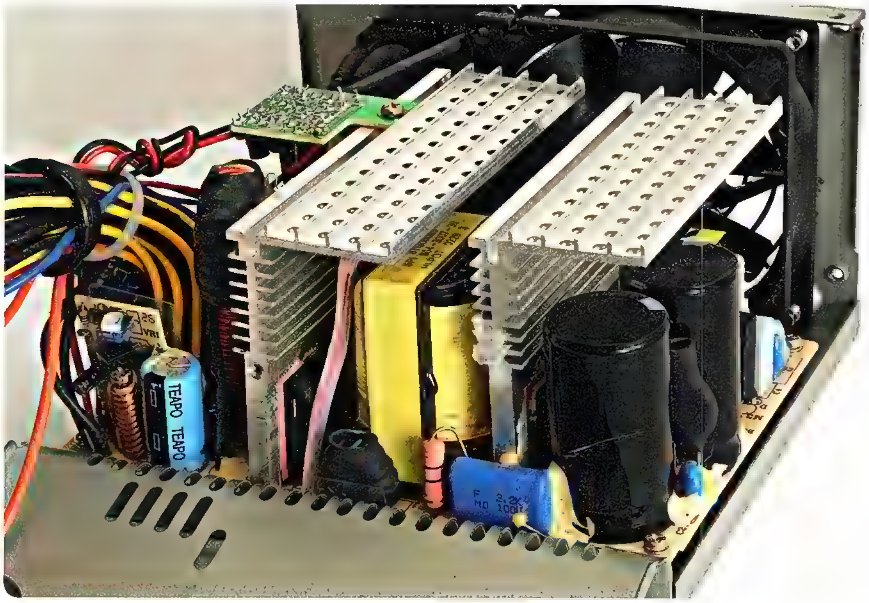
POWER SUPPLY

PC power consumption is, as you'd expect, usually dominated by CPU and graphics-card wattage. It's pretty easy to get even low-end CPUs to draw a big old slab of watts by overclocking; power consumption increases directly with clock speed, but also with the *square* of any voltage increase you have to use to get an overclock to work. So if you increase voltage by 10 per cent to get a 20 per cent overclock, power consumption increases by a factor of 1.1-squared times 1.2, or 1.45.

The Thermal Design Power (TDP) for the Radeon HD 5770 is 108 watts. No Core i5 CPU so far has a TDP above 95 watts.

The TDP is the most power a component is supposed to ever draw for any length of time. It's the power number that's used



I haven't found one with scrap-iron weights in it yet, but it's only a matter of time.

when designing the cooling system for the computer. You can squeeze CPUs and graphics cards up a little past the TDP if you really, really try, but even if you're running some distributed-computing application that keeps your CPU at 99 per cent utilisation all day long, you're probably not exceeding the TDP. This is because different tasks light up different areas of the processor, and also hit the cache memory (which takes up a lot of real-estate on a modern CPU) differently. Tasks that all apparently cause the same level of CPU utilisation can consume quite different amounts of power.

So taking TDP as a realistic maximum figure, a 108W-TDP graphics card plus a 95W-TDP CPU give a peak draw of 203 watts just for the CPU and graphics card. The whole system's realistic peak draw won't ever exceed 300W, and probably not even 250W.

And remember that this is a ceiling power figure. Real-world power consumption for this Core i5 system, even when you're playing a game and working both CPU and graphics card pretty hard, could easily average out at less than 200W, even after overclocking.

There sure are 300-watt graphics cards out there, though, and you don't even need to buy a dual-GPU card. As I write this, the top-of-the-line single-GPU ATI graphics card is the Radeon HD 5970, which has a TDP of 228 watts at stock speed. The top single-GPU Nvidia card is the GeForce GTX 285, which tops out at 204 watts. Overclock these with gusto and you could get very close to 300 watts.

PSU efficiency, like a lot of environmentalist issues, makes a difference to the planet but not much of a difference to the individual user. Many PSUs these days have excellent efficiency at a variety of load levels, but even if you've got a computer that draws 300 watts, 24 hours a day, a 70 per cent-efficient PSU will draw 429 watts from the wall, while a 90 per cent-efficient one (which will pass the 80 PLUS 'gold' test) will draw 333W. Even if you pay a quite high (for Australia) 20 cents per kilowatt-hour, the less efficient PSU will only cost you about $42 per year.

Cracking screen, Gromit!

I My MP3 player has a cracked screen. Except it hasn't.

The screen IS definitely cracked (don't know how I did it), but every time I've seen a picture of a cracked LCD it's gone all crazy with the whole area around the break completely illegible, and my screen is still readable. It just looks as if I'm reading it through a cracked car windscreen.

Does this mean I can fix the screen without replacing the whole panel?

Marcus Judkins

O Yes, it is at least in theory possible to fix the screen, without buying a whole new LCD module.

What you've managed to do is crack the glass cover over the panel itself, without cracking the panel. So all you need is something to replace that cover.

There are a heck of a lot fewer LCD panel sizes than there are LCD panel types, so the glass from some other panel may work fine. But you just try *finding* separate glass that's the right size.

Fortunately, your MP3 player probably doesn't have any fancy coatings on its glass, or, if it does, you won't really mind giving them up. In that case, you could probably just go to a glass shop or picture-framing place and get some thin glass cut to the right size. (You can even get anti-reflective glass, made for museums and art galleries.)

This screen damage, you can fix.

This screen damage, you can't.

Replacing a laptop or LCD monitor's glass with ordinary window glass is a pretty bad idea. If you thought it had an annoyingly reflective glossy screen before, wait until you see it with window glass!

Glass replacement is also just plain impossible for a lot of LCD panels, because the relatively few monitor and laptop LCDs that have glass on the front at all, usually have that glass bonded solidly to the LCD sandwich. There are a few exceptions, like the iMac monitors that have the glass held in place by magnets around the edges, but usually glass-fronted LCDs are more like the 'unibody' Macbooks, in which the whole screen-and-lid assembly isn't meant to be repairable at all.

Note that you also can't replace the glass on most touchscreens, like – to stick with this impromptu Apple motif – the iPhone and iPod Touch. The touch sensor is bonded to the glass, so you have to buy both together.

All these disclaimers aside, though, the glass covers on small LCD screens (cameras, media players, maybe digital photo frames...) are often quite easy to remove, with a hair dryer to soften the adhesive and a suction cup and/or sticky tape to pull the glass off. You can often even buy an actual official perfect-sized replacement part, either brand new or parted out from a dead device.

Dueling DMGs

I A while ago, I had to burn a DVD-RW for use on a Mac, from an image file. The image file name ended in .dmg, which nothing in Windows could cope with, but I read on a forum that you can just rename a .dmg to .iso, and it'll work. It DID work!

Yesterday, though, I had to do the same thing with a different DMG, and it didn't work at all. I might as well have been renaming an AVI or a MP3 to ISO and trying to burn that.

Has the DMG format changed? What's going on?

Seth Fisken

O Dot-DMG files are Apple Disk Images, which are indeed *based* on the simple ISO standard.

DMG also, however, supports compression and encryption, on top of ISO. If a given DMG uses either of these extra features, the file becomes undecipherable for anything that doesn't support DMG.

There are a number of readily-Googleable ways to convert these DMGs to ISOs on a PC, but I think they're all either pretty painful, or require commercial software. So if it's at all possible, try to translate the file on a Mac. OS X's 'hdiutil' console utility makes this pretty simple.

Bespoke PCs

James Gorbold and **Anthony Leather** show you how to build four different PCs, each optimised for running different applications

While many of the pages of Atomic are dedicated to finding out which upgrades and tweaks will improve your gaming and larger computing experience, there's a lot more you can do with your PC than using it to crush your enemies and see them driven before you. However, while any PC will be able to create 3D animations or edit photos, like a gaming rig, there are a number of hardware and software tweaks you can perform to optimise the experience.

Our first bespoke PC is a small form factor system designed for listening to music away from your main PC, which can be operated without having to rely on an external monitor, keyboard or mouse. The second system is a variation on the classic 'Mid-priced gaming PC' that has been optimised for editing high-resolution photos.

The third PC is a DAW (digital audio workstation), and as its name implies, it's designed for recording, editing and remixing music. The fourth and final system is a graphics workstation that's perfect for creating 3D models and animations in record time, but is still capable of playing the latest games.

JUKEBOX PC

A PC that's built primarily for music playback is going to be very different from the other bespoke PCs we're looking at in this article. In short, it should be as cheap as possible. There's simply no need to opt for cutting edge high-end hardware when there are cheaper components available that are capable of running an operating system and your favourite music player.

There are other factors to consider too. Low-power components mean that making a smaller, quieter PC is a much more viable option, as there'll be less waste heat with which to contend. We also considered the best way to control our jukebox. Is a keyboard and mouse really necessary if you'll only be playing music? Fewer cables would also mean a neater arrangement, so it wouldn't look out of place in a domestic environment.

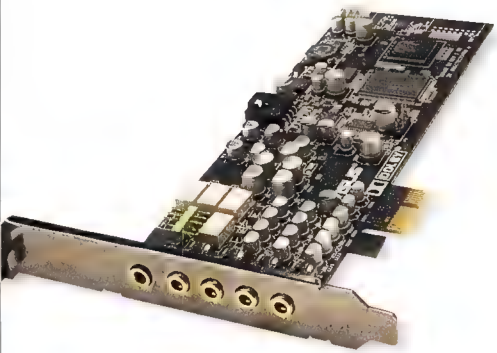
THE CASE

Shuttle XPC D10, $374

If you're only using a PC for playing music, you'll probably want to tuck it out of the way; this calls for a PC that's small, quiet and as cable-free as possible.

Shuttle's XPC D10 is our case of choice, as it includes an LGA775 motherboard, PSU and CPU cooler. It's limited to processors with a TDP of 100W or less, but as a result, it's small and draws very little power. Most importantly, it has a 7in touch-screen located in the front of the case, so our jukebox wouldn't need an external monitor. The screen produces sharp images, and has excellent viewing angles and a native resolution of 800 x 480.

This means that once you've set up your music collection, you can use the touch-screen to control the jukebox. We found that Media Center's oversized icons were the easiest to control with the touch-screen, but iTunes and other players are also possible, although with no keyboard, you're limited to listening to existing playlists.



THE PROCESSOR

Intel Celeron E3300, $55

Playing music on a PC or streaming it through the Internet doesn't require a vast amount of processing power. As such, the CPU is definitely one component on which you can afford to save money when building yourself a jukebox PC.

As we're using an LGA775-compatible Shuttle bare bones system, Intel's dual-core Celeron E3300 fits the bill nicely. It's one of the cheapest CPUs you can buy, but still packs enough of a punch to run Windows 7 smoothly. As we're building a small PC based around a Shuttle chassis, it's a good idea to use hardware that doesn't generate a lot of heat too. The E3300 has a TDP of just 65W, which means that the CPU cooler in the Shuttle case doesn't have to spin particularly fast or loudly.

THE SOUND CARD

Asus Xonar DX/XD 7.1 PCI-E, $110

Although the Shuttle D10 has good-quality on-board sound, we decided to fill the vacant 1x PCI-E slot in the Shuttle D10 with an Asus Xonar DX/XD sound card. This will ensure a pleasurable listening experience, thanks to its superior SNR and audio processing capabilities.

THE MEMORY

Crucial CT2KIT6464AA667, $85

Gone are the days when 2GB of RAM was ample for new gaming PCs. While Windows 7 is much perkier and less resource-hungry than Vista, it can gobble up more than a gigabyte before you open any programs. However, if you aren't doing anything more demanding than playing music, you can get away with much less RAM than the amount required by a gaming system.

To cut some more corners with the cost, we found that 1GB was enough to handle Windows 7 while running iTunes or Media Center. It's still worth opting for a set of two 512MB sticks, though, so that the RAM runs in dual-channel mode.

THE HARD DISK

320 GB Western Digital WD3200AAKS Caviar Blue, $55

As you aren't using the PC to store videos, photos and games, a 320GB hard disk should be more than adequate to house your music collection. Opting for a smaller 160GB or 250GB hard drive barely saves any money, and you'd end up with a lot less storage space.

THE OPTICAL DRIVE

Samsung TS-H353B, $35

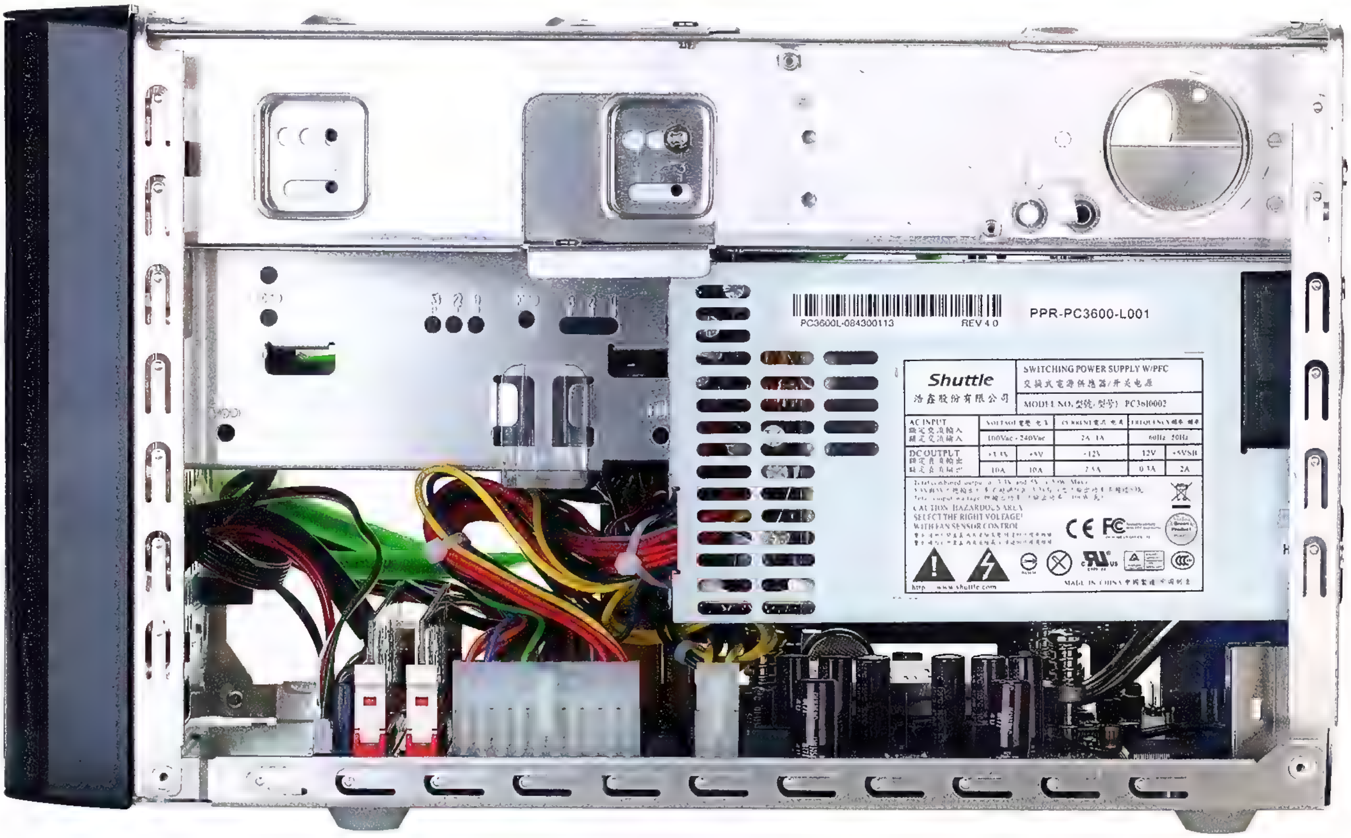
Many people have CD collections as well as a hard drive full of MP3s, so we included an optical drive in the form of Samsung's TS-H353B. Being able to read CDs and DVDs will also make installing the OS and other software much easier too.

THE KEYBOARD

Visenta V1 2.4Ghz wireless keyboard, $105

The Shuttle D10 features a 7in touch-screen which can be used to control your music player, but as you'll occasionally need a keyboard, we opted for a Visenta V1 wireless keyboard with an integrated touchpad. This will allow for much greater control over the PC should you need it.

Total price
$900



THE OPERATING SYSTEM

Microsoft Windows 7 Home Premium OEM, $100

With Windows XP costing the same as Microsoft's latest operating system, it makes sense to opt for Windows 7, which also includes Media Center.

For Linux savvy readers who want to save money, many distributions of the free OS incorporate basic music playback software. You can also download the Linux drivers for the D10's touch-screen from **http://touchkit.com/linuxdriver.htm**

PHOTO EDITING PC

People have edited photos on PCs for years, but with the advent of digital cameras, nearly all of us now use image editing programs such as Photoshop to enhance the vast collections of photos on our PCs. While any PC can edit photos you can drastically reduce the time it takes to do this, particularly with large images, by using the right components.

Even a powerful gaming PC isn't the right tool for the job. Editing large photos or batch-processing collections can take a ridiculously long time if your system is lacking in a few key areas. A fast CPU and lots of RAM are the first ports of call, but there are other factors that come into play when building a PC for photo editing. You also have to think carefully about backing up your photos too.

THE CASE

Antec Nine Hundred Two, $165

A mid-range PC needs some serious cooling, as it's likely to house some toasty hardware in the form of quad-core processors and graphics cards that can provide playable frame rates in modern games. The Antec Nine Hundred Two has three 120mm fans and a huge 200mm fan as standard. All are adjustable via speed controllers, using either dials on the front of the case or switches on the rear.

This means that you can turn the fans right down when gale-force cooling isn't required. There's space for numerous 3.5in and 5.25in drives, and the motherboard tray has several convenient cut-outs that aid cable tidying.

THE PROCESSOR

Intel Core i5-750, $240

While you need specific graphics cards to support features such as CUDA or DirectX 11, any CPU will work for photo editing. However, it's still a case of the faster the better. When editing photos, you'll probably have several demanding programs, such as Adobe's Photoshop or Lightroom, running at the same time.

In addition, some photo editing tasks are quite demanding, and Intel's Core i5-750 will help your PC chew through those batch-processing runs. The Core i5-750 has 8MB of Level 3 cache and four cores, but is still very fast in single-threaded applications.

THE CPU COOLER

Arctic Cooling Freezer 7 Pro Rev.2, $40

It's rare that a CPU cooler is able to perform well and remain quiet at the same time. Arctic's Freezer manages to achieve both with flying colours, though, and beats many coolers hands down. It's more than capable of coping with a stock speed Core i5-750, and should you decide to overclock your PC, there's plenty of cooling headroom too.

THE GRAPHICS CARD

Sapphire Radeon HD 5850, $400

As our photo editing PC is aimed at hitting some good gaming, too, we decided to go with the Sapphire Radeon HD 5850 graphics card.

THE MEMORY

Corsair CMX8GX3M4A1333C9, $350

If there's one upgrade you can make to improve photo editing performance and reduce the time it takes to churn through those batches of photographs, it's extra memory. With modern compact cameras able to capture images at 12MP and high-end DSLR cameras almost double this, photo editing can require huge amounts of RAM.

If you're using Windows 7 or Vista, the chances are that up to 1.5GB of RAM will be used up before you even start editing your photos, so it goes without saying that having 2GB is far from ideal. If you're dealing with large images, batch processing, photo merging or stacking then even 4GB might not provide enough headroom, and your PC may start dipping into your pagefile, slowing down the process considerably.

DDR3 RAM is much cheaper now than it was a few years ago, but 4GB is still expensive. However, if you're serious about photo editing then it's well worth opting for even more. We chose 8GB of Corsair Dominator DDR3 1,333MHz, a perfect partner for the Core i5-750 CPU.

THE STORAGE

2 x 1TB Samsung SpinPoint F3, $110 each

If you're shooting in RAW mode, images taken on the latest DSLR cameras can be more than 30MB in size. This means that just 100 photos will take up 3GB of space. Even modern compacts can see several gigabytes used up following a shutter-happy holiday. Needless to say, you'll need more storage than you can shake a stick at to store your photo collection, especially as many cameras can also capture video, and you can often end up with several

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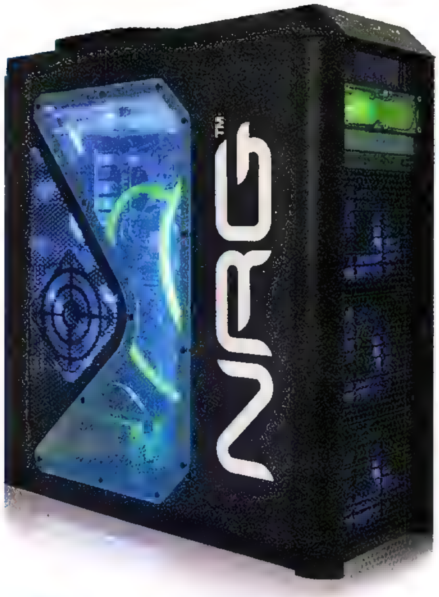

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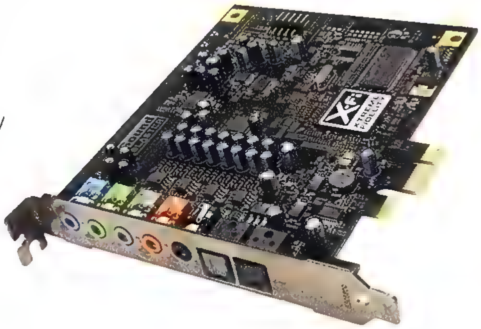
copies of photos with different tweaks and effects applied to them during editing.

We opted for two 1TB Samsung HD103SJ SpinPoint F3 disks for our photo editing rig. The F3 is fast and offers an attractive cost per GB, and two of these will allow you to use one drive as a backup.

We configured one drive to be the home of Windows and all the applications we installed, with the remaining space partitioned off as a backup for the secondary drive. The secondary drive houses the main photo collection, as you can see some improvement in performance if your photo editing software reads the photos from a different drive.

We used Windows 7's Backup and Restore feature to make a copy of our photos on the disk. Backing up is essential, and Backup and Restore can be set to run automatically, so if one hard drive fails, you'll have a second, up-to-date copy of your photo collection. This is far easier than keeping archives of DVDs, and it's far quicker than uploading them to online storage too.



THE SOUND CARD

Creative X-Fi Titanium, $115

A sound card isn't essential for a photo editing PC, as all motherboards have some form of on-board audio, but if you'll be using the PC for gaming or music and video playback then it's definitely worth considering ditching the on-board audio.

Creative's X-Fi Titanium has a far superior signal-to-noise ratio than on-board audio, so your music and games will sound cleaner and crisper. We're also big fans of the X-Fi Crystalizer, which greatly enhances the sound quality of music. Games can benefit considerably too, thanks to EAX, which adds realistic effects that are beyond the capability of basic sound cards.

THE OPTICAL DRIVE

Samsung SH-S223C, $40

Despite optical drives being noisy and slow, and many people installing their operating systems from USB sticks using programs such as WintoFlash, it's still worth having an optical drive. In a photo editing PC, this can be useful for reading CDs of family or friends' photos, making your own discs of your round-the-world trip to hand out at the next family get-together or taking your photos to be printed.

THE OPERATING SYSTEM

Microsoft Windows 7 Home Premium OEM, $100

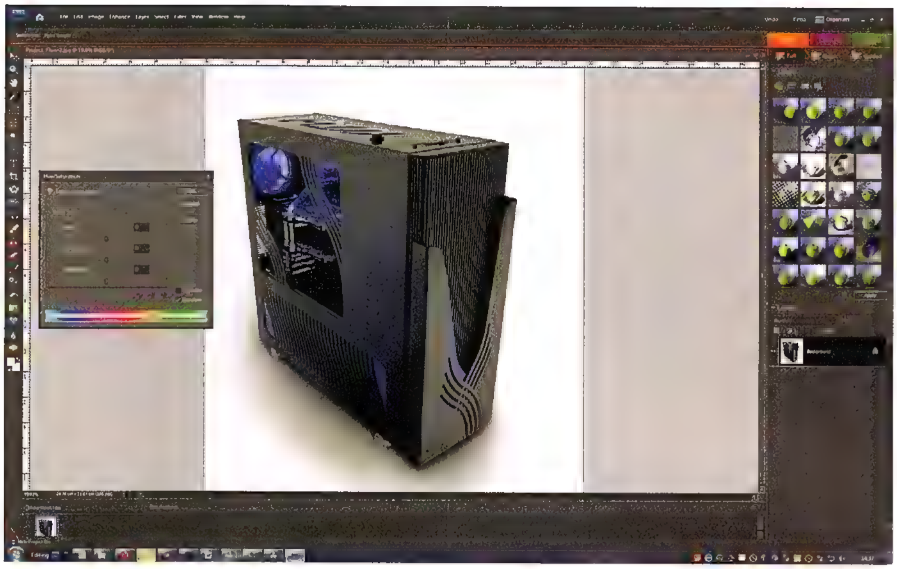
At last there's a reason to upgrade from Windows XP, and it isn't just because Windows 7 supports later versions of DirectX; it's a great operating system in its own right and puts Vista to shame. It's perky, responsive and has plenty of features that are useful for photo editing, such as snap, which allows you to quickly and easily run two folders or programs side by side. It also has a great backup and restore utility included, which is very useful for backing up your photos. Make sure that you install the 64-bit version so that software can take full advantage of the full amount of RAM.

THE MONITOR

HP LP2475w, $1200

Monitors are often overlooked whichever activity you use your PC for. With photo editing, the larger the screen and higher the resolution the better, as it makes viewing and editing photos a much more pleasant experience.

However, the panel technology can also make a huge difference. TN and PVA panels are common in the sub-$400 price bracket and most people have these on their desks.



However, TN panels in particular suffer from poor colour accuracy and often struggle with dark shades, making them less than ideal for photo editing.

If you can afford it, an IPS-based monitor has far greater colour accuracy and vibrancy, so much so that your photos aren't only displayed more accurately, but also look better too. IPS monitors have a similar effect on games and movies too. The HP LP2475w is a 24in H-IPS display that features a native resolution of 1920 x 1200, making it great for photo editing.

THE TABLET

Wacom Bamboo Pen, $90

It's now easy to find good entry-level graphics tablets for less than $100. Our recommendation, the Wacom Bamboo Pen is just about the best of this price point.

You might think that tablets are only for people who actually want to draw illustrations on the computer, but in fact, they're very handy when you're post-processing photos, allowing you to more precisely select areas of the image, which makes cloning out unwanted objects very easy. They also allow the more natural application of effects such as colour dodging and burning to bump up highlights and shadows in specific areas without needing to change the levels of the entire image. The Bamboo Pen's only real downside as an entry-level model is its compact size; it's big enough for photo manipulation, but too small for drawing freehand.

TESTING THE PHOTO EDITING PC

To stretch our photo editing PC's legs, we loaded 36 21MP images into Photoshop CS4 and ran them through a batch process, making some basic colour adjustments in the process. We didn't set a save location, instead leaving the photos open for editing afterwards; this saw the RAM usage skyrocket to nearly 6GB by the end of the run.

The process took 169 seconds with 8GB of a RAM installed. We then removed two sticks, reducing this to 4GB and ran the batch test again. The time taken to complete the task increased significantly to 201 seconds. Having more RAM can clearly reduce the time taken to perform many photo editing tasks and this was with just a few dozen photos. Performing the same task with several hundred photos after a day out with your camera could see many minutes shaved off the time it takes your PC to churn through them.

With a powerful gaming PC at its heart, our photo editing PC is quick at games too. 8GB of RAM is more than enough to run current games, too.

DIGITAL AUDIO WORKSTATION

While only a few strange people derive any joy from a noisy PC, the most important consideration for a gaming rig is its 3D performance. In contrast, while processing digital audio is also relatively computationally intensive, what matters most is a quiet PC. Even if you aren't working in a professional recording studio, there's no point in having a noisy PC that introduces white noise into your recordings/remixes.

Like the photo editing PC, our DAW (digital audio workstation) is based more or less on a gaming rig, but has been tweaked so that it's more suited to remixing tunes than being used to headshot aliens.

THE CASE

SilverStone PS02, $70

2 x Sharkoon Silent Eagle 1000, $22

We thought it best to build our DAW inside a different case than our previous build. This is because the Nine Hundred Two is designed for high airflow, with both the front panel and roof being made of a large metal grille. While this really aids cooling, it also allows a lot of noise to escape from the computer. So, for our DAW, we wanted to use a case with fewer holes in it.

Our choice was the neat-looking SilverStone PS02, which we further improved by replacing its rear fan with a 120mm Sharkoon Silent Eagle 1000 and fitting another Silent Eagle 1000 to the front air intake. We chose these fans because they won an award in a recent Head2Head, thanks to their good airflow and extremely quiet operation.

THE PSU

Seasonic X-650, $210

Low noise is absolutely critical for a DAW. Therefore, although it's a lot more expensive than many, we opted for a Seasonic X-650 instead. It's also rated at 650W and has modular cables, but more importantly, it's so efficient that its cooling fan only spins up when the PSU is at full load – something our DAW will never require it to do. Effectively, at least in the way that we're using it here, the Seasonic X-650 is a passively cooled PSU and makes no noise whatsoever.

THE PROCESSOR

Intel Core i5-750, $240

While many digital audio applications are very well multi-threaded, and can take advantage of lots of cores, unless you work in a professional recording studio, you probably won't require a $6,000 dual-processor 12-core Xeon rig, as tempting as it always is to have more power on hand. Instead, for our DAW, we've chosen to use a Core i5-750, a great choice for any mid-range PC, thanks to its excellent performance, ample overclocking headroom and competitive price. For more details on why we chose the Core i5-750, see Testing the DAW.

THE SOUND CARD

M-Audio Audiophile 192, $270

While the on-board audio is usually considered 'good enough' for a basic PC, and an X-Fi pretty much mandatory for a gaming rig, neither is up to par for a DAW. On-board audio/consumer sound cards usually only have one or two inputs (line-in and microphone), a fairly noisy SNR (sound-to-noise ratio) and comparatively laggy drivers. For example, the X-Fi Xtreme Gamer has a SNR of 109dBA, while the on-board codecs found on most motherboards have an SNR of less than 80dBA.

In contrast, the M-Audio Audiophile 192 professional sound card we've chosen for our DAW has a far superior SNR of 113dBA and drivers that have been optimised for recording and remixing, rather than playing games or movies. It has two analogue inputs, an optical S/PDIF input/output, four analogue outputs and a MIDI connector, so you won't be constantly scrabbling around behind your PC switching cables.

THE CPU COOLER

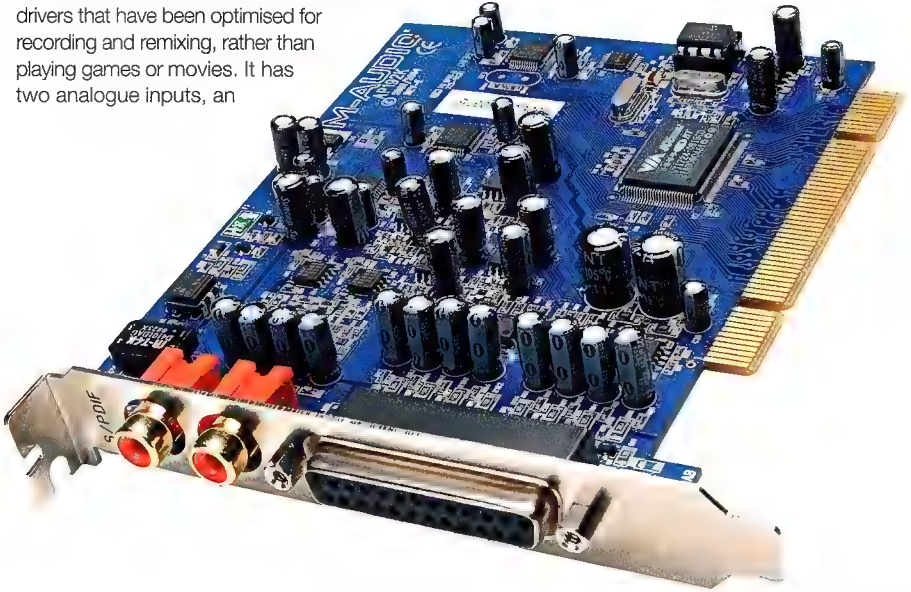
Arctic Cooling Freezer 7 Pro Rev.2, $40

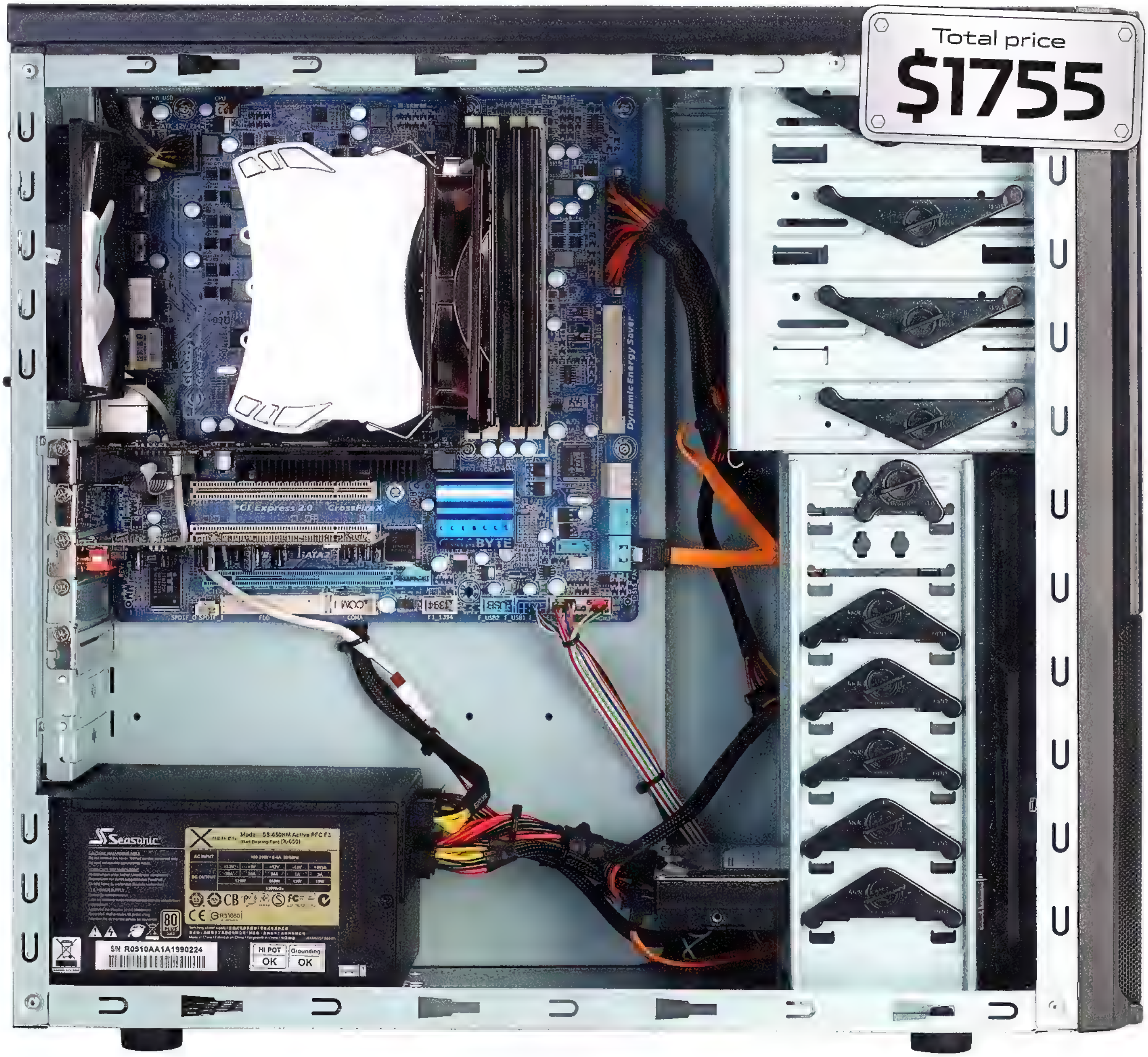
It's rare that a CPU cooler is able to perform well and remain quiet at the same time. Arctic's Freezer manages achieve both with flying colours, though, and beats many coolers hands down. It's more than capable of coping with a stock speed Core i5-750, and provides room if you want to dabble in overclocking to boot.

THE MOTHERBOARD

Gigabyte GA-P55M-UD2, $130

The compact Gigabyte GA-P55M-UD2 is one of the best LGA1156 motherboards to buy, thanks to its good performance, user-friendly BIOS, excellent overclocking potential and keen price. The GA-P55M-UD2 is a particularly good base for a DAW, as its two FireWire ports are powered by a Texas Instruments TSB43AB23A controller. This will prove useful if you already own or are planning to upgrade to an external sound interface, as these work best with Texas Instruments FireWire controllers.





Total price
$1755

THE MEMORY

Corsair CMX8GX3M4A1333C9, $350

Although most sequences stream samples direct from the hard disk, it pays to have plenty of RAM in a DAW when dealing with large recordings. Therefore, our DAW is fitted with an 8GB kit of Corsair XM3, comprising four 2GB DIMMs. When buying RAM, it's always a good to use matching DIMMs that have been tested together (such as buying an 8GB kit rather than two 4GB kits). Our particular RAM is rated up to 1,333MHz, so it has a reasonable amount of room for overclocking (see Testing the DAW).

THE GRAPHICS CARD

XFX Radeon HD 4350, $55

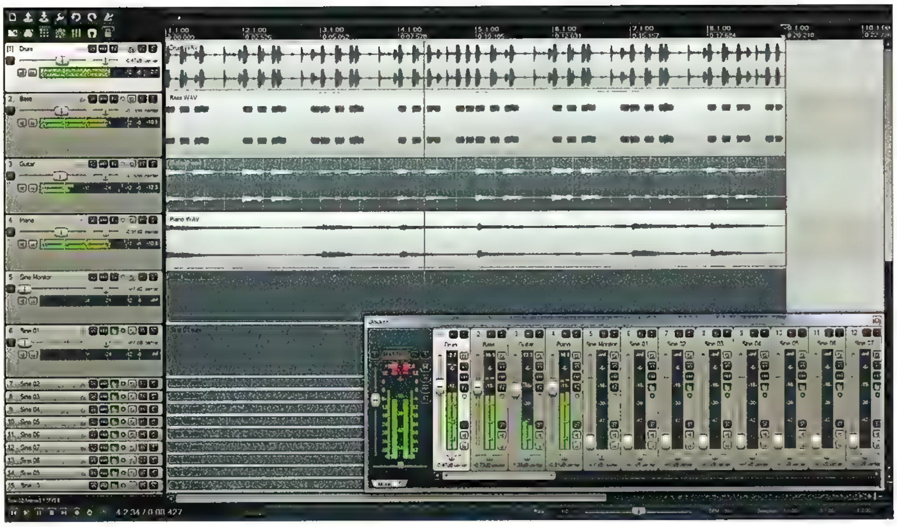
Initially, we wanted to build a dual-purpose DAW/gaming rig by reducing the noise of a Radeon HD 5850 with a third-party cooler. Unfortunately, all the replacements coolers we tried that claimed compatibility with the HD 5850 were a nightmare to fit, so instead, we settled on using a passively cooled graphics card. As passive coolers can't shift much heat, this limits the type of graphics card you can buy; although the XFX Radeon HD 4350 we opted for is more than adequate for running audio editing applications, it's hopeless for gaming. Unfortunately, this means that if you want to play anything more complicated than a Flash game, you'll need to build a dedicated gaming rig.

THE STORAGE

1TB Samsung SpinPoint F3, $110
Samsung SH-S223C, $40

With noise at such a premium, you might think an SSD would be the ideal choice for a DAW. Unfortunately, as a DAW will write data almost continuously when recording/remixing, this will quickly wear out an SSD, since NAND flash has a limited number of write cycles.

Unless you're made of money and can afford a RAM drive, this means you have to buy a fast hard disk, such as the Samsung SpinPoint F3. We've specified its 1TB incarnation, so there's plenty of room for different remixes and two copies of the operating system (more on this later). We've also specified a Samsung DVD burner, although any optical drive will suffice - the cheaper the better.



THE OPERATING SYSTEM

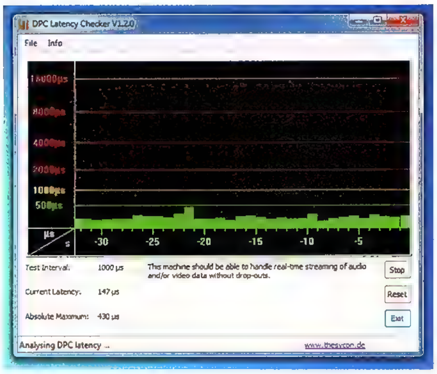
2 x Microsoft Windows 7 Home Premium OEM, $100 each

Until very recently, many professional sound cards didn't have 64-bit drivers; nor did they work well with Vista or Windows 7. Fortunately, that's now changing, with companies such as M-Audio, the maker of our sound card (see above), leading the charge towards 64-bit DAWs. It's of significant benefit to go 64-bit, as it means that you can build a system with more than 4GB of RAM, which will really help when with large recordings. As it's a good idea to set up two different Windows installations on your DAW (see Essential Tweaks, below), we recommend buying two copies of Windows 7, and setting up each copy on its own partition.

ESSENTIAL TWEAKS

As digital audio applications are very sensitive to latency (your recordings will be punctuated with pops and crackles), it's worth performing a few tweaks to minimise the chance of a rogue application suddenly requesting CPU time. Prime culprits for this sort of occurrence are spyware, anti-virus applications and other background tasks.

As it isn't a good idea to connect to the Internet without these applications running, we'd recommend setting up two copies of Windows 7, each on its own partition. The first installation you can think of as your everyday installation, complete with security software, MSN, Skype and so on. The other installation should be stripped back as much as possible – the less running in the background the better.



Test Interval: 1000 µs

Current Latency: 147 µs

Absolute Maximum: 430 µs

This machine should be able to handle real-time streaming of audio and/or video data without drop-outs.

Analysing DPC latency ...

www.thesycon.de

You can also tweak Windows 7 on the DAW partition. Starting in Control Panel, you should disable any power-saving technologies so that the hard disk doesn't go to sleep at an inopportune moment. It's also a good idea to disable SpeedStep in the BIOS, otherwise the CPU may step down to 1.6GHz to save power just at the wrong moment.

Back in Windows, it's also a good idea to disable indexing by going into Control Panel > Administrative Tools > Services and finding Windows Search. Enter the Properties of Windows Search and change the Startup type from Automatic to Disabled.

TESTING THE DAW

ANALYSING LATENCY

Once the system was up and running, we wanted to make sure that our music making wouldn't be adversely affected by excessive latency in the system. Excessive latency can be caused by badly written device drivers (often network controllers), resulting in distortion in your music.

You can check the latency in your system by running the applet DPC Latency Checker, which is freely available to download from www.thesycon.de/deu/latency_check.shtml. Simply leave DPC Latency Checker running for a few minutes without any other foreground applications open, and note the current and maximum latency values. For a DAW, you're looking for a value below 1000us (highlighted in yellow on the graph). As an example, our DAW has a maximum latency of 430us, so it's responsive enough for making music.

MULTIPLE BAND COMPRESSION

One of the most CPU-intensive tasks a DAW will be challenged with is performing a multiple band compression on a recording. Compressing the dynamic range – not to be confused with compressing the bit-rate to create a smaller file – is often necessary when you're trying to balance the output from more than one microphone. This is achieved by altering the volume of certain frequency bands for a better mix. However, the more bands you want to compress, the more powerful a CPU your DAW will require.

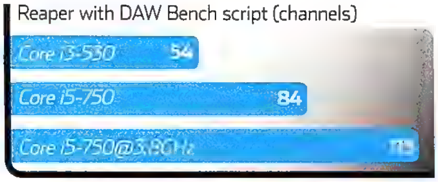
To analyse how many bands our DAW could handle, we used the DAW Bench script created by Vin Curigliano, using the popular audio production application Reaper. This script plays back a simple 4-channel recording, allowing you to incrementally add channels on which to perform compression until you hear distortion, such as hiss, cracks and slowdown being introduced into the recording.

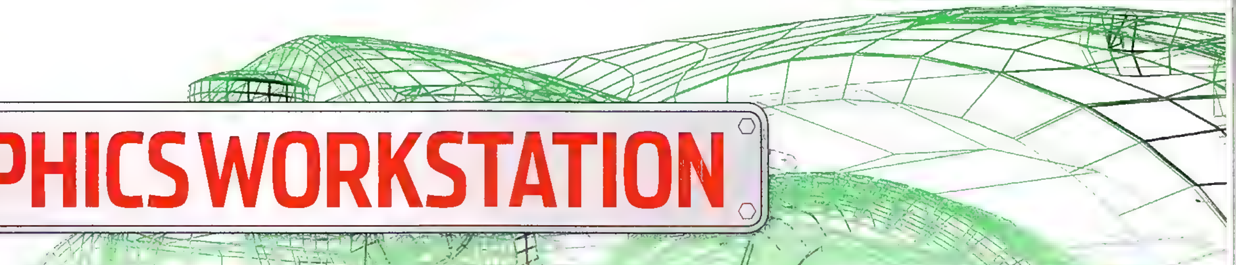
To keep down costs, our initial DAW recipe used the excellent dual-core Core i3-530. However, the DAW Bench script revealed that this budget CPU could only handle 54 channels before distorting the recording. To put this number in perspective, a typical rock/pop group with several instrumentalists and a single vocalist could have as many as 30 channels. This means that a DAW powered by a Core i3-530 will struggle if you're trying to remix anything more complex than this.

With this information in mind, after trying several other LGA1156 CPUs, we decided to base our DAW on the quad-core Core i5-750 instead, as it manages 84 channels without distortion. This provides far more headroom for adding more channels or bands. In fact, it's arguable that unless you're trying to remix an entire orchestra at once, a Core i5-750 is more than adequate for multiple band compression on your DAW.

OVERCLOCKING

That said, being Atomic, we couldn't help but find out what difference overclocking makes. As we wanted our DAW to be stable 24/7 so that it didn't crash during a long remixing session, we overclocked the CPU from 2.66GHz to 3.8GHz. According to DPC Latency Checker, this overclock reduced the maximum latency of our DAW from 430us to 92us, and increased the maximum number of bands that Reaper could compress simultaneously from 84 to 115. These are fantastic increases in performance, so the overclock is well worth doing.


Reaper with DAW Bench script (channels)



GRAPHICS WORKSTATION

If you thought that a gaming rig had to have plenty of horsepower up its sleeves then think again – the PCs that are used to make games and movies, known as graphics workstations, require even more power. Graphics applications used to make 3D effects are incredibly computationally intensive, and therefore require a barrel-load of CPU and GPU horsepower, plus a ton of RAM.

Like our photo editing and DAW PCs our graphics workstation is intended to double up as a gaming system, as it's obviously more convenient to have one system under your desk rather than two.

THE PROCESSOR

Intel Xeon W3520, $360

Unlike all the other bespoke PCs in this feature, we started the recipe for the graphics workstation with the CPU; despite what Nvidia might have you believe, the CPU is the most important component in a workstation.

However, while it was very tempting for us to specify a monstrous dual-processor Xeon 5500-series system with eight physical and 16 logical cores, this doesn't make a whole lot of sense to buy at the moment, unless you must have the fastest workstation right now with money no object. For that, you may as well go with Gulftown, which we discovered to be blindingly fast, and stupendously expensive, last issue. Probably too expensive for what we want to do with this build, to be honest.

With that in mind, our workstation will be based around standard existing desktop components (with a twist), so that you can build it now and easily upgrade to Gulftown later on (after selling a kidney). However, unlike a gaming system, workstations are likely to run at full load for hours on end, so stability is paramount. A great way to aid stability is to use ECC RAM, as opposed to standard unbuffered RAM.

Therefore, our workstation uses a Xeon W3520 CPU, a close cousin of the Core i7-920 of many high end systems. It runs at the same clock speed (2.66GHz) and has exactly the same cache architecture, but its pre-fetchers have been tweaked for workstation and server applications rather than games. Most importantly, however, unlike the Core i7-920, which only supports unbuffered DDR3, the Xeon W3520 supports both unbuffered DDR3 and ECC DDR3 (although not at the same time). Given that the W3520 is about the same price as the Core i7-920, we reckon that it's worth it for the added peace of mind of ECC RAM.

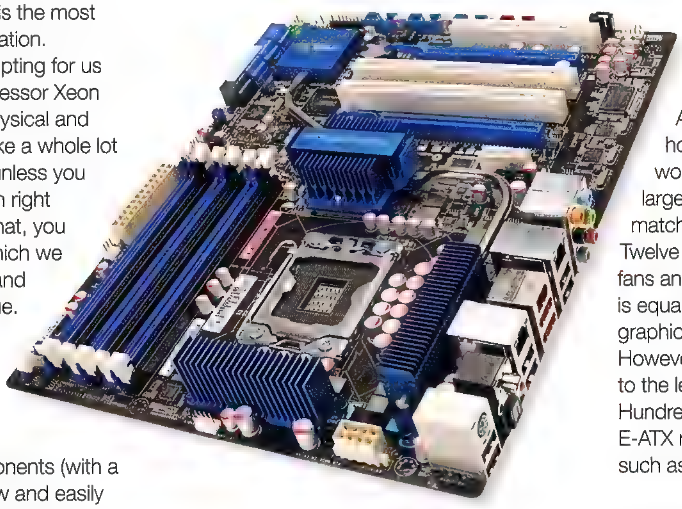
Incidentally, as Xeons are better binned than Core i7s, the Xeon W3520 is also a brilliant overclocker.

THE MOTHERBOARD

Asus P6T WS Professional, $500

Our workstation is built around the Asus P6T WS Professional. This motherboard is about the same price as many high-end X58 motherboards, but has a number of workstation-friendly features.

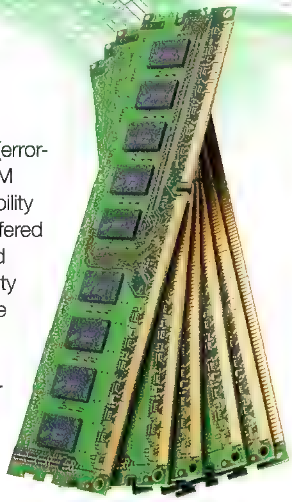
First and foremost, it supports ECC DDR3 (although you could use standard unbuffered DDR3 should you wish). As a workstation motherboard, it also sports better-quality VRMs and cooling than most gaming motherboards, while the BIOS has been tweaked for stability under heavy load. Other workstation-friendly features include two PCI-X slots, in addition to the two 16x PCI-E, one 1x PCI-E and one PCI slots. There are also two SAS ports for connecting high-speed hard disks or SSDs.



THE MEMORY

2 x Crucial CT3KIT25672BA1339, $US225 each (via crucial.com)

One of the biggest differences between our dual-purpose graphics workstation/gaming rig and a conventional gaming rig is its use of ECC memory. ECC (error-correcting code) RAM provides greater stability than standard unbuffered RAM, as it reads and writes additional parity bits to check that the main data hasn't been altered by a faulty memory cell or transmission error. ECC RAM is more expensive than unbuffered RAM, but we think the extra cost is worth it for the added peace of mind when building a workstation. As workstation applications store work with large datasets, we've specified 12GB for our workstation in the form of two 6GB kits.



THE CASE

Antec Twelve Hundred, $240

As we'll be installing a lot of large, hot-running components in our graphics workstation, it makes sense to house it in a large case with excellent airflow. Few cases match up to the high standard of the Antec Twelve Hundred, thanks to its 12 drive bays, six fans and two additional fan mounts. This case is equally at home housing our dual-purpose graphics workstation/high-end gaming rig. However, if you aren't following this PC recipe to the letter, it's worth noting that the Twelve Hundred is too small to house a dual-processor E-ATX motherboard; for that, you'll need a case such as the SilverStone TJ07B-W.

THE PSU

Antec True Power New 650W, $150

The Antec True Power New has plenty of power (650W) for our single-processor system with its solitary graphics card. Even if you wanted to add another graphics card at a later date, it has four PCI-E power plugs and could therefore handle two cards.

THE CPU COOLER

Arctic Cooling Freezer 7 Pro Rev.2, $40

This cooler is simply awesome across the board, for just about any build.

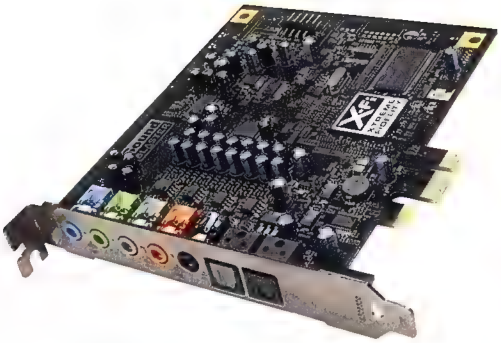
THE GRAPHICS CARD

XFX Radeon HD 5870, $600

Although both ATI and Nvidia produce a range of workstation-class graphics cards – FireGL/FirePro and Quadro FX respectively – these aren't worth buying unless you work in a professional 3D studio or need access to one of their special features, such as genlock. This is because these cards are significantly more expensive (up to 22x) than a similar-spec gaming graphics card, yet will typically only be five to 10 per cent faster. ATI and Nvidia aren't ripping you off, however, as these cards typically have much more RAM than gaming graphics cards and the drivers are certified to run with specific workstation applications. What's more, many workstation cards have their own dedicated support line and are covered by a 24-hour replacement service.

However, if you're trying to build a semi-professional graphics workstation/gaming rig without blowing a Death Star-sized hole in your wallet, you're far better off saving your money and buying a gaming graphics card instead. It won't be certified to run workstation applications, but it will still run them, only not quite as well.

For this reason, we've opted for the same Radeon HD 5870 graphics card we've been loving since it was released last year. This is practically identical to the GTX480, and will cope with almost any game or workstation app you throw at it.



THE SOUND CARD

Creative X-Fi Titanium, $115

As we won't be making music on the graphics workstation, we can get away with a cheaper X-Fi Xtreme Titanium sound card. This card provides much better sound quality and positional effects than on-board audio, but costs nearly half the price of a professional sound card.

THE STORAGE

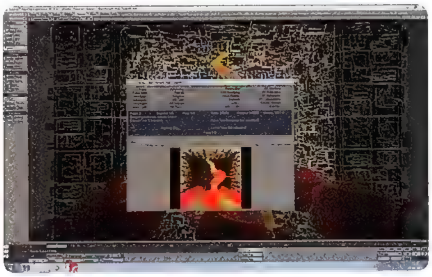
1TB Samsung SpinPoint F3, $110
Samsung SH-S223C, $40

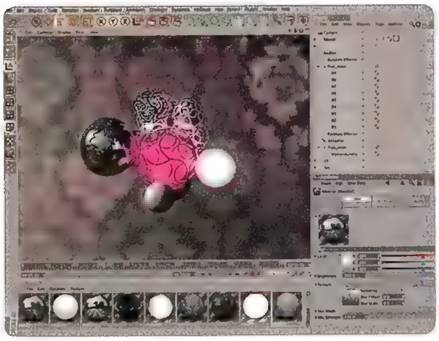
As NAND flash prices are currently very unstable and rising all the time, we'd advise against buying an SSD right now. This means that you'll need a fast and capacious hard disk for storing all those textures, models and renders. Our recommendation is the 1TB Samsung SpinPoint F3. We've also specified a Samsung DVD burner, although any optical drive will do - the cheaper the better.

THE OPERATING SYSTEM

Microsoft Windows 7 Home Premium, $100

As you need a lot of RAM when manipulating graphics and complex models, especially in 3D, a graphics workstation should always have a 64-bit operating system. We can think of no better choice than Windows 7 Home Premium; the more expensive versions are only required if you're planning to install more than 16GB of RAM or a dual-processor motherboard.





TESTING THE GRAPHICS WORKSTATION

CINEBENCH

To measure how fast our system was we installed Cinebench. This benchmark is based on Cinema4D, a 3D modelling and animation package used in the production of many games and films, such as District 9. Our graphics workstation scored 16,458 in the CPU rendering test, which compares very favourably with an identically configured Core i7-920 that scored 15,053. Given that both CPUs are clocked at the same frequency and have the same cache architecture, the nine per cent performance difference between the two systems shows that it's well worth buying a Xeon W3520 for a graphics workstation. Our workstation also demolished our Core i5-750-powered photo editing PC, as it scored 14,052 under the same conditions. However, if your budget can stretch, a pair of Xeon W5580 remains the fastest system we've measured in Cinebench, with an unparalleled score of 28,980. You can download Cinebench from www.cinebench.com and compare its performance on our systems with that of your own system.

LIGHTWAVE

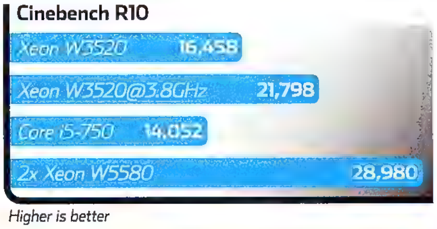
Another commonly used workstation application is Newtek Lightwave, which is also used in the production of games, films and TV shows, such as Battlestar Galactica. The benchmark we used was developed by www.3dspeedmachine.com and renders a single frame of complex animation using the CPU. Our workstation took 149 seconds to complete this test, compared to a much longer 191 seconds on our photo editing PC. Once again, the pair of Xeon W5580s was faster still, taking just 66 seconds, although it's worth remembering that our workstation is less than half the price.

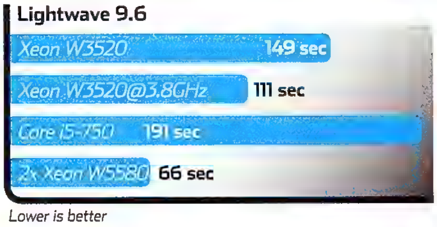
CRYSIS

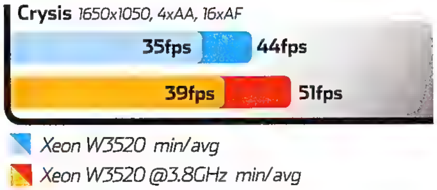
As our intention was to build a system equally suited to running intensive workstation applications and playing games, we also ran our system through Crysis. Fortunately, as our workstation includes a Radeon HD 5870, the fastest single-GPU gaming graphics card available, it's also a monster in Crysis, returning a super-smooth minimum frame rate of 35fps and an average of 44fps at 1,680 x 1,050 with 4x AA and 16x AF. In short, our workstation will run any game smoothly at high resolutions.

CONCLUSION

Unlike a pair of Xeon W5580s, which are currently impossible to overclock, we chose the components for our workstation so that it could be overclocked. As the components are very similar, you can use our step-by-step guide for overclocking a Core i7-920. By doing this, we overclocked the Xeon W3520 from 2.66GHz to 3.8GHz. Although you could push the CPU much further, you'd run into problems with the Crucial ECC RAM, and have to swap it for higher-frequency unbuffered memory. At 3.8GHz, our overclocked workstation received a significant performance boost, completing the Lightwave test in 111 seconds and Cinebench with a score of 21,798. Crysis also ran significantly faster, with the minimum and average frame rates jumping up to 39fps and 51fps respectively. These results show that it's well worth overclocking a workstation, as it will dramatically lower rendering times.







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- 256MB Onboard Cache (1TB)
- Dual-Controller Design
- Read: Up to 260MB/s
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HARDWARE

NEWS, REVIEWS AND ROUNDUPS ON THE LATEST HARDWARE

Big hardware stuff is hitting you hard and fast this month, with NVIDIA's long-awaited Fermi card featured in a gigantic three-page analysis. The card for you? Perhaps!

We've also taken a look at MSI's funky Big Bang Fuzion board, an overclocking rocket from Manli, and plenty of other tech including the first 890GX motherboards in the country.

On top of the exciting tech reviews, we've thrown together not one but *two* Head2Heads for you this issue! Within their slightly-smaller-but-still-lengthy frames lie the knowledge you need for those upgrades that you always wondered about, but never seemed to get around to.

If this isn't enough tech to sate your lust (and by all means should be), we're a monkey's uncle.

Powered by msi™

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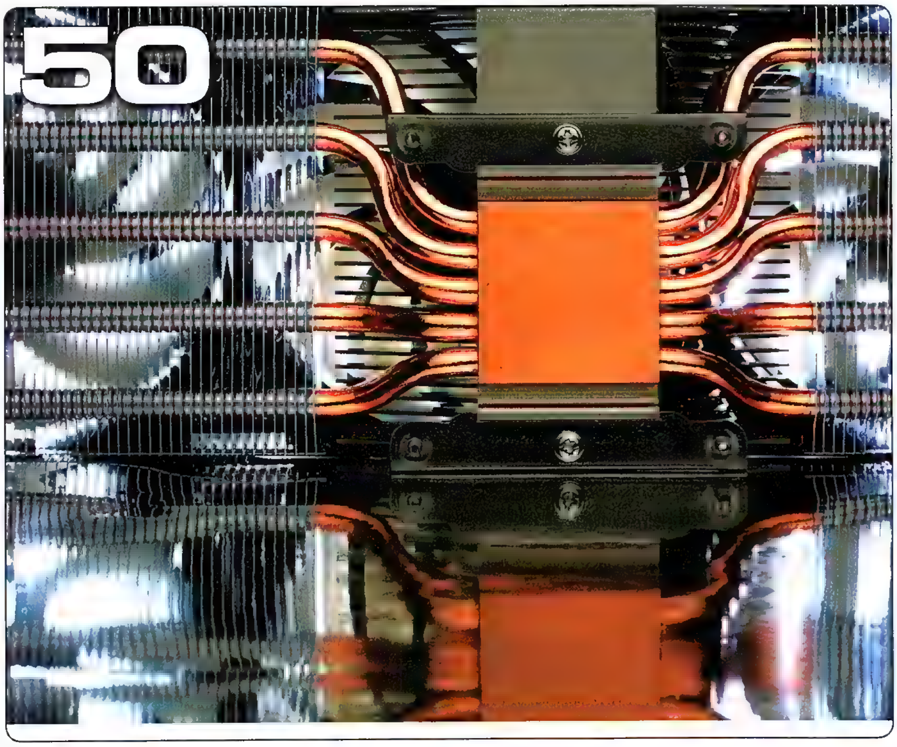
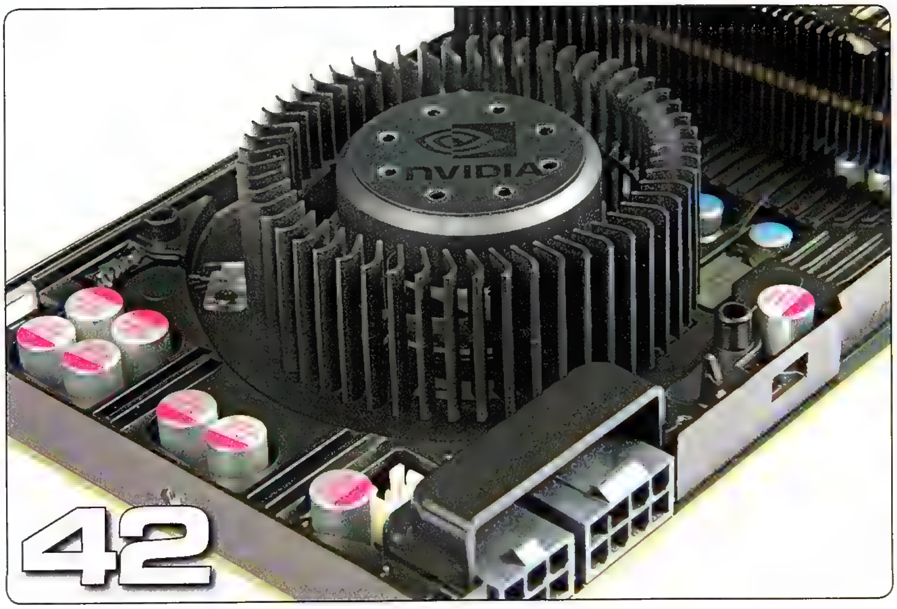
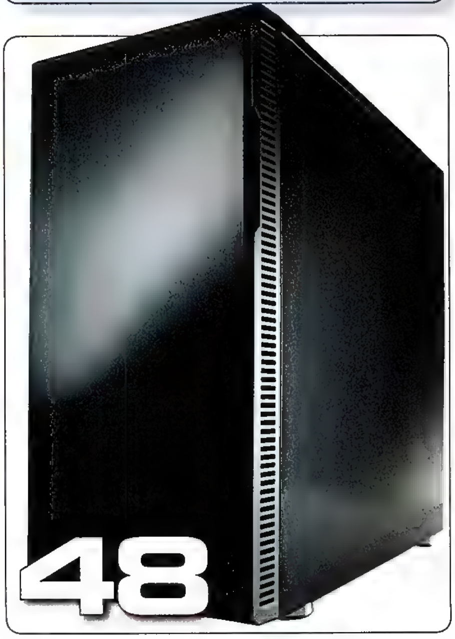






MSI Big Bang Fuzion

An emphatic disappointment.

Street Price $580 **Supplier** MSI
Website www.msi.com
Specifications Socket LGA1156; Intel P55 chipset; Lucid Hydra 200; ATX form factor; 3x PCIe x16 (2x8 w/ Crossfire); 2x PCI; 2x PCIe x1; 10x SATA2; DDR3-1866+

The motherboard space is very hard for manufacturers to innovate in – with a reliance placed upon bigger players such as Intel to embrace the latest features, the only alternative is to add these desired features in with add-on chips. We've seen this a lot in other boards, using the Marvell SATA3 and NEC USB3 chips to grant access to the latest storage standards; but the Fuzion offers neither of these options. Nor does it quite offer native SLI support, but we'll cover that point in just a minute.

The chipset used as the backbone of the Fuzion is not the X58; rather MSI's engineers have gone with the P55, which presents an unfortunate limitation on PCIe bandwidth. However, there are three full size PCIe slots included. These are all able to be used, but in a way that we've never quite seen before – managed by a Lucid Hydra 200 chip.

The Hydra 200, specifically the LT22102, is a dedicated hardware chip that boasts a x16 PCIe uplink stream with a x32 downlink stream. Effectively similar to the PLX bridge chip used in other designs, this multiplication of PCIe lanes gives huge bandwidth between the two primary PCIe slots, though the Hydra only receives x16 bandwidth from the LGA1156 socket. The remaining slot is powered by the P55 chipset's spare lanes. But simply rearranging the PCIe lanes isn't what the chip is supposed to do; instead, it's a radical re-thinking of graphics technology from the hardware level upwards.

Being placed at the top of the system, or 'mountain', means that the Hydra has complete control over where the graphical workload can flow. It also means that the SLI and Crossfire bridges are unnecessary; the cards don't communicate with each other at all, and simply do the work they're given by the Hydra. Fantastically, this also means that you can use heterogeneous pairings of cards from NVIDIA or ATI (think mixing a GT220 with a GTX285, or 4450 with a 4870). Even more incredibly is the ability to mix cards from different vendors – you can run a GTX285 in tandem with a 4870 *at the same time!*

However, this system has some serious limitations. First and foremost, it's entirely dependent on too many drivers on the software side: the Lucid drivers must be the latest version, and you can only use compatible NVIDIA/ATI display drivers *as supported by the Lucid driver.* Not only does this limit you to sometimes months-old drivers, but it also precludes the use of the latest drivers that add new features. On top of all this is the need for each game to have a profile included, and if the game you're playing doesn't have one, you'll get an error – and if you try using a newer driver, you'll get a "Current vendor driver not supported" message. To make matters worse, you can't use the latest 5xxx or GTX4xx cards, and to top it all off, the performance when using the Hydra actually moves backwards – making it technically possible to do, but ultimately pointless.

So yes there is a good motherboard under all this stuff; yes it does overclock very well and actually hit a phenomenal 4378MHz at 198x22 with 1.475V, but it's also a motherboard with crippled dual-card graphics performance. It doesn't have support for the latest storage standards, nor does it have native SLI support if you don't want to use the Hydra, and finally, it clocks in at almost six hundred dollars. No matter which way you cut it we can definitely say this; it's an impressive technical achievement, but it is in no way worth buying. **JR**

MSI Big Bang Fuzion

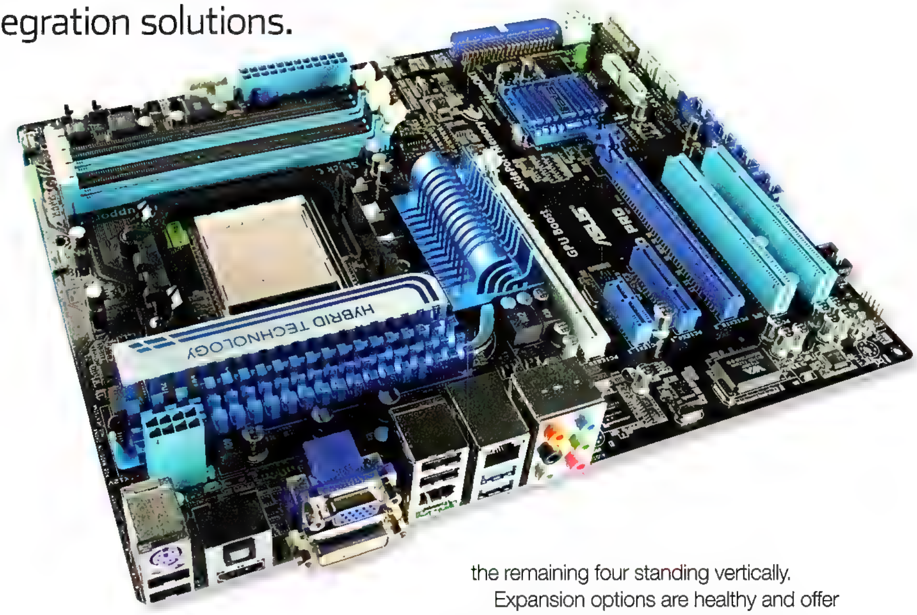
i7870	133x22; DDR3-1600 8-8-8-24	150x22; DDR3-1500 8-8-8-24	175x22; DDR3-1400 8-8-8-24
PiFast	24.26s	24.09s	20.76s
wPrime 32M – single thread	37.128s	36.082s	31.59s
wPrime 32M – multi-thread	8.003s (4.64x efficiency)	7.302s (4.94x)	6.194s (5.10x)
CineBench R10 64-bit – single thread	4902	5097	5948
CineBench R10 64-bit – multi-thread	18551 (3.78x efficiency)	20788 (4.08x)	24039 (4.04x)
Everest Read	14478MB/s	15371MB/s	15956MB/s
Everest Write	10907MB/s	12235MB/s	14268MB/s
Everest Latency	46.4ns	45.5ns	44.3ns

Performance	Great overclocking, graphics go backwards.	75
Value	There's no reason to buy it.	41
Features	Old storage, Lucid chip.	81
Build	Amazing design win.	95
Overall	The weirdest design choices we've seen yet.	63%

ASUS M4A89GTD-PRO

An AMD board with neat integration solutions.

Street Price $200 **Supplier** ASUS
Website www.asus.com
Specifications Socket AM3; AMD 890GX chipset; ATX form factor; 2x PCIe x16; 1x PCIe x4; 1x PCIe x1; 2x PCI; 6x SATA3, 2xSATA3; 2xUSB3; DDR3-1866+



AMD has recently launched its latest chipset into the desktop fray, bringing around what we had hoped to be a new wave of performance and features. While AMD has certainly pinned features down admirably, performance is one thing that isn't likely to have changed much in this case – the 890GX chipset is effectively the same as the 790GX. The only difference that we can see is the inclusion of an ATI HD4290 graphics core, a slight bump in specs over the previous chipset's HD3300, but as seen in the boxout it's nothing to upgrade over.

Manufactured on a 55nm process, the 890GX chipset isn't the star of the show here – rather, that responsibility falls to the SB850 Southbridge chip. It's connected through a stronger link to the 890GX, providing more bandwidth for interconnectivity around the system, and packs native SATA 3 support in for the first time. AMD has even beaten Intel to the punch with this chip, and every one of the six SATA ports here support the full spec and all the bandwidth that entails.

IGP performance

The integrated graphics core is never going to set the world on fire with its red-hot performance; being based around the ancient RV620 core with only 40 stream processors, it's got an onboard allotment of 128MB of DDR3 chips. Performance in 3DMark Vantage was an abysmal P427, with a 3DMark06 benchie result of 2233 proving that it's only just good enough for games older than five years. Still, desktop use doesn't strain it at all, and HD playback is completely offloaded from the CPU. We're more than happy to see it here.

The design of ASUS' flavour of this 'board is slightly quirky compared to traditional layouts; while the PWM circuit is commonly cooled with heatsinks, generally they're not so large that they interfere with the 8-pin power connector. To save gigantic fingers the trouble of squeezing between heatsinks and I/O ports, ASUS simply made the 8-pin connector three times as tall, resembling a gigantic tower. It's of dubious strength, so try to limit the amount of connecting you do here.

An AM3 socket supports the latest processors, though again thanks to that nefarious PWM heatsink it's placed very close to the four DDR3 slots and can cause interference with large aftermarket coolers. The DDR3 slots themselves sport the convenient latching system that ASUS has been using recently, only locking down on one side to ease installation. That weird MemOK! button makes another unnecessary reappearance, though the presence of a right-angled IDE port is a welcome sight. Frustratingly there are only two right-angled SATA ports, with the remaining four standing vertically.

Expansion options are healthy and offer support for two cards at full bandwidth in Crossfire, while legacy PCI devices and the newer PCIe 1x/4x interfaces are also supported. Thanks to the inbuilt HD4290 graphics, there are outputs on the rear I/O panel that cover both HDMI/DVI and VGA; impressively being able to be run in tandem with a HD5450 card to boost performance. If you've got the need for *slightly* more graphics grunt you've got the option.

Overclocking was better than we've seen before, hitting a maximum of 3872MHz with a speed of 242x16 at 1.4718V. The BIOS was pretty forgiving of incorrect settings, and even handily prompted to automatically handle DRAM voltage whenever the memory was set to be over 1600MHz (which we politely declined). For an updated chipset that boasts SATA3 and a decent IGP, this is a decent upgrade for those running older AMD systems – but if you've got a 790 board it isn't worth the change. **JR**

Performance It's good for AM3. **90**

Value Affordable enough for what you get. **80**

Features Ticks all the boxes. **86**

Build Decent, though the 8-pin tower is quirky. **84**

Overall A great way to leap into the 890GX platform. **86%**

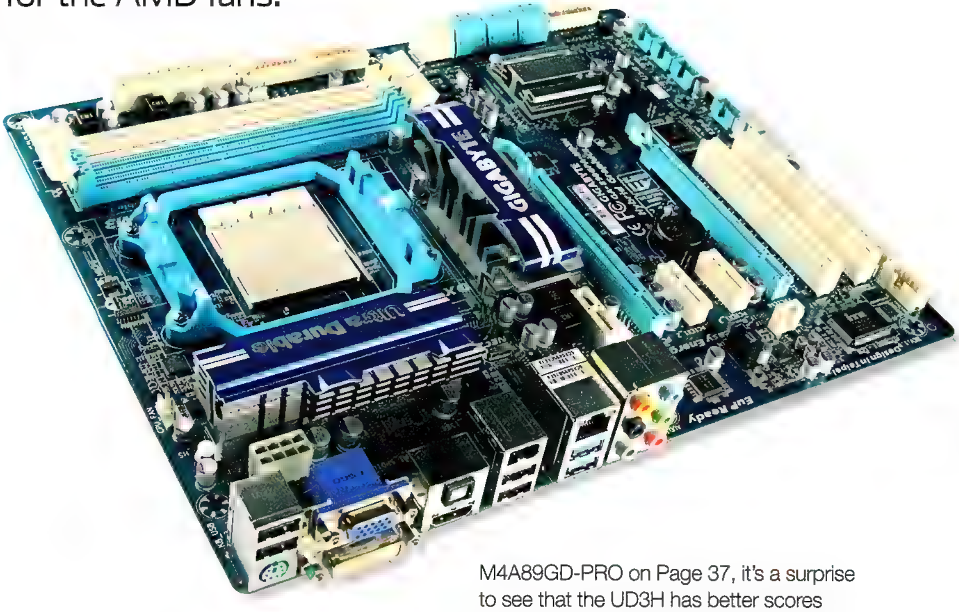
ASUS M4A89GTD-PRO

X4955	200x16; DDR3-1333 7-7-7-21	217x16; DDR3-1446 7-7-7-21	230x16; DDR3-1532 7-7-7-21
PiFast	33.98s	31.17s	29.58s
wPrime 32M – single thread	46.566s	41.619s	38.764s
wPrime 32M – multi-thread	12.013s (3.88x efficiency)	10.875s (3.83x)	10.481s (3.70x)
CineBench R10 64-bit – single thread	3738	4052	4620
CineBench R10 64-bit – multi-thread	13602 (3.64x efficiency)	14776 (3.65x)	15183 (3.56x)
Everest Read	8480MB/s	9105MB/s	9147MB/s
Everest Write	6778MB/s	7354MB/s	7107MB/s
Everest Latency	51.9ns	48.4ns	47.8ns

GIGABYTE 890GPA-UD3H

It's a pretty average offering for the AMD fans.

Street Price $200 **Supplier** GIGABYTE
Website www.gigabyte.com.au
Specifications Socket AM3; AMD 890GX chipset; ATX form factor; 2x PCIe x16; 3x PCIe x1; 2x PCI; 6x SATA3, 2xSATA2; 2xUSB3; DDR3-1866+



Years ago, the most you could expect from a motherboard was that it'd technically turn on and (if you were lucky) give you a few POST beeps. These days however, we're both seeing and expecting a lot more from these slabs of silicon, and keeping the ball rolling on both counts is an increasing challenge. GIGABYTE hasn't had any trouble keeping up in the past, but with every new chipset launch there is always a measure of uncertainty.

Based around the 890GX chipset, this board packs in a relatively slow graphics core that is a rough equivalent to a HD4290. It's technically DX10.1 capable, but you'd have to be bonkers to bother trying to actually play a DX10 game on it, and even DX9 will stress it. Interestingly you've got control over clockspeeds in the BIOS, and the core clock of 700MHz can be raised in increments, but ultimately no amount of overclocking will ever get it to be usable in games.

The PWM heatsinks are coated in GIGABYTE's latest racecar styling, and seem barely capable of handling the heatload generated. On top of this, the tiny heatsink that lies on the SB850 chipset handles heat as well as a self-absorbed Broadway performer handles bad reviews. It heated up quickly and hugely, hitting finger-scalding temps without airflow and merely uncomfortable temps once under the flow of a decent fan; pretty damn unacceptable for a modern board. Hopefully the BIOS engineers can do something about this, but it's still an oversight that should have been corrected long before this stage.

Thankfully the rest of the board is relatively neatly arranged, with the 8- and 24-pin connectors sitting in their usual positions. A vertical IDE port lies near the six right-angled SATA3 ports that come from the SB850 chip, but they're also joined by an additional two SATA2 ports that are fuelled by an additional chip. There's a bunch of USB and firewire headers at the bottom of the board for flexibility, and there's even a Floppy port for those hoarders who simply refuse to let the interface die.

Expandability continues when looking at the rear I/O panel; four USB2, one PS/2, DVI/HDMI, VGA, Optical, 6-pin FireWire, Gigabit Ethernet, two USB3 and 7.1 channel audio are on offer. There's heaps of choice here, and while only a single digital output can be used at a time, the analogue output gives the capacity for dual-monitors without the need for an additional graphics card. It's a nice way of getting HTPC duties mixed with home use, since you can run a HDTV and hi-res monitor at the same time.

Comparing the stock performance of GIGABYTE's 890GX board to the ASUS M4A89GD-PRO on Page 37, it's a surprise to see that the UD3H has better scores across most benchmarks, only missing out on Cinebench and Everest memory tests. Unfortunately the situation ain't so peachy at the second and third OC levels, with the PRO whooping the UD3H across most of the benchmarks at identical settings.

Even the overclockability of the UD3H seems restrained, no doubt hindered by the southbridge, and we only eked out a max speed of 3776MHz at 236x16 with 1.5V. This is a less-than-average result, and is a shame considering the pedigree of the manufacturer. While the BIOS was perfectly functional and organised the settings clearly, it just didn't feel quite finished even with the latest F4 BIOS used at time of writing.

In all, if the southbridge issues can be cleared up this board will prove a nice choice with extra storage options packed in. **JR**

GIGABYTE 890GPA-UD3H

X4955	200x16; DDR3-1333 7-7-7-21	217x16; DDR3-1446 7-7-7-21	230x16; DDR3-1532 7-7-7-21
PiFast	33.63s	31.20s	29.41s
wPrime 32M – single thread	44.929s	43.086s	39.092s
wPrime 32M – multi-thread	11.902s (3.78x efficiency)	11.308s (3.81x)	10.578s (3.70x)
CineBench R10 64-bit – single thread	3586	3961	4095
CineBench R10 64-bit – multi-thread	13042 (3.64x efficiency)	14095 (3.56x)	14882 (3.63x)
Everest Read	8327MB/s	8800MB/s	9322MB/s
Everest Write	6790MB/s	7293MB/s	7773MB/s
Everest Latency	53.1ns	49.7ns	46.9ns

Performance 75
Pretty average.

Value 72
Not too appealing.

Features 89
Adds some flexibility.

Build 64
Some serious southbridge suckage.

Overall
Needs work to feel complete, and is way too hot.

75%

MANLI 5670

Makes overclocking look effortless.

Street Price $175 **Supplier** Bluechip Infotech
Website www.bluechipit.com.au
Specifications 775MHz core; 1000MHz memory (4000 effective); RV870 'Redwood XT' core; 400 shader units; 1024MB GDDR5; 128-bit memory interface; dual slot PCB with active cooling
Card info www.techpowerup.com/gpuz/z37wb

33% OC

Budget graphics cards, themselves the result of architectural engineers hacking and slashing away at higher-end cards, are typically well-known for their decent performance. However, most people haven't discovered the *best* part about them; they're generally very overclockable. Increases can typically be seen in a range from 15-25 per cent, netting you extra performance without spending any more money. Manli has now come along and rewritten this range, blowing the top limits of the overclock to 33 per cent!

Starting with the cut-down RV870 'Redwood XT' core, Manli's slapped a custom heatsink on top. It's as basic as they come, being shaped like a flower with the fins of the heatsink spreading outwards, crafted entirely from aluminium. The PCB is dark red, which looks a bit odd with a neon orange fan and blacker-than-your-soul heatsink, but it looks tolerable. Twin Crossfire nipples are present, along with a 16x PCIe slot through which the card draws all its power. A small fan sits in the middle and blows through the fins, passing cool air over the memory chips in the process. Stock clocks are the reference speeds; 775MHz for the core, and 1000MHz for the 1GB of GDDR5 memory chips.

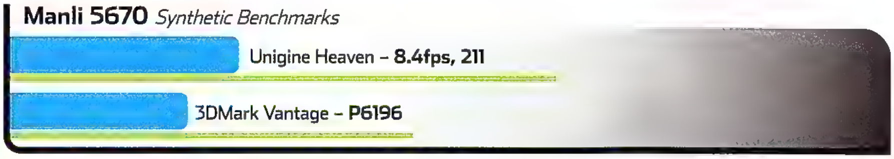
When we fired up our testrig, with the card sitting by itself in the open air without any additional cooling, we didn't expect to get anywhere near the result we did. The core clock just kept increasing, to the point where we set it to a ridiculous 1200MHz just to see if it was actually increasing (turns out it was, and the screen went a lovely shade of purple before the system hard reset). Finally we settled on 1030MHz – a fantastic 255MHz increase on air cooling alone! Representing a 33 per cent increase, this is a great result; the 18 per cent speed increase on the memory chips only added another layer of performance to Manli's cake of epic overclockingness.

Apart from being great fun to overclock, the 5670 doesn't fare too shabbily in games. The 1GB of GDDR5 provides just enough wiggle room to run GRID at a decent clip, though the card isn't powerful enough to run a DX11 game at high resolutions as shown with the Heaven test. Vantage scores are pretty much the same as other 5670 cards, while Crysis flexes its muscles slightly faster thanks to the extra memory space available.

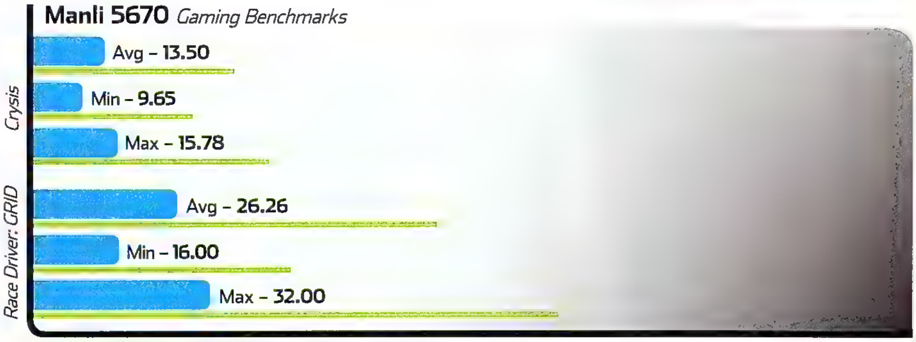
The card idled at a very low 32 degrees Celsius thanks to its ultra-low idle TDP of 14W, rising to 54 degrees under load. Strangely this result is *hotter* than the reference cooler! The fan seems to be the culprit here, and even though it made a constant 62.2dBA it never seemed to be pushing a huge volume of air. If a better fan were used temps would be even lower, though it didn't seem to hinder overclocking prowess at all.

Unfortunately, you'll be paying a price premium to grab this model with the heatsink, even though it's warmer than the reference design – and much louder too. This places the Manli 5670 in a tricky position. On one hand it's a great overclocker, more than capable of playing older games at a great framerate, and uses very little power. On another it's more expensive for a hotter, noisier heatsink. Ultimately this card is great for those who want to play around with overclocking an inexpensive GPU for the hell of it, or for the gamer who likes the colours (they exist, somewhere), but for most we'd suggest sticking with a standard 1GB 5670. **JR**

Manli 5670 *Synthetic Benchmarks*



Manli 5670 *Gaming Benchmarks*



= Reference scores: XFX 5850

Frames per second

Performance	It's a fantastic overclocker!	85
Bundle	Nothing at all.	65
Value	It's ok, but could be better.	75
Build	Inelegant cooling, but great clocking.	78

Overall
Overclocker extraordinaire, hindered by bundle and heat.

80%

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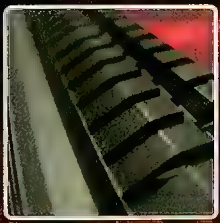

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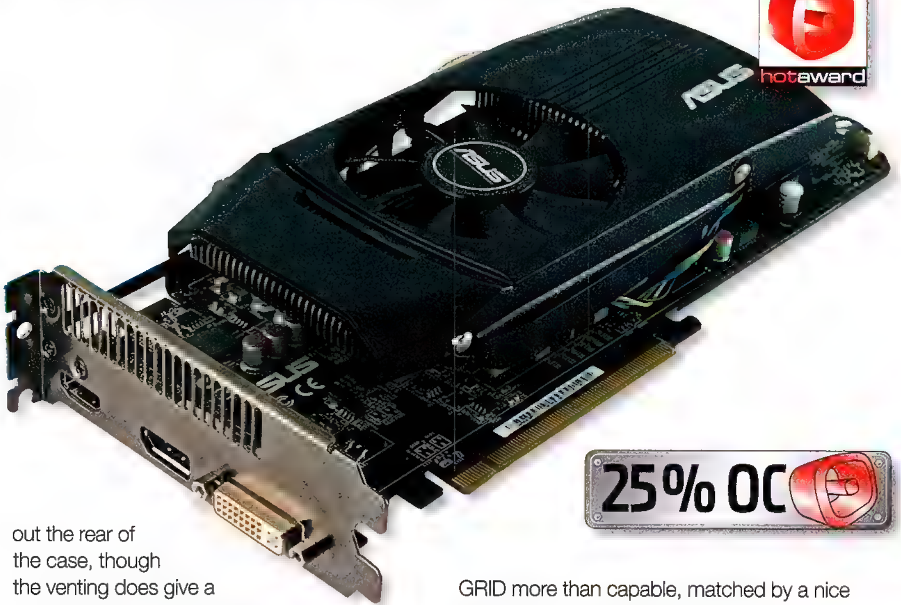
Blacktea Tech http://www.bttech.com.au
Computer Alliance http://www.computeralliance.com.au

ASUS 5830 DirectCU

A superlative overclocker.

Street Price RRP$469 **Supplier** ASUS
Website www.asus.com.au
Specifications 800MHz core; 1000MHz memory (4000 effective); RV870 core; 1120 shader units; 1024MB GDDR5; 256-bit memory interface; dual slot PCB with active cooling; 8-pin, 6-pin PCIe power connector
Card info www.techpowerup.com/gpuz/93pgq



25% OC

There has to be a line drawn somewhere between price and performance, but since we're Atomic we can't draw that line too far down – which is where the 5830 steps in.

Based around the same RV870 core that the entire range is built upon, the 5830 boasts a complement of 1120 shader units, less than the 5870's 1600 units but more than the 5770's 800. Clock speeds are actually quite high, at a stock of 800MHz, while the 1GB of GDDR5 memory keeps the same speedy 256-bit memory bus that the more powerful cards also have. Manufactured on the same 40nm process as the entire range, power needs at idle are a slim 25W, though load is a surprising 175W. The source of this extra heat generation is of course the power-guzzling cores being run at the higher clockspeed, burning through electrons faster than a bunker-busting missile slices through a bowl of jelly.

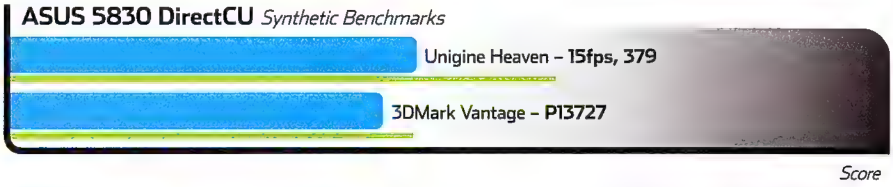
To curb this extra heat, ASUS has whacked its custom DirectCU heatsink on the card. This, as the name suggests, boasts copper heatpipes that are machined flat to form a smooth surface that mounts against the RV870 core, sucking away the heat more efficiently than in other designs. These heat-filled tubes mate with a series of aluminium fins buried underneath a black plastic shroud, spreading the heat across a larger surface area where the large fan can push it away quickly. Sadly it doesn't exhaust out the rear of the case, though the venting does give a small amount of airflow. Idle temperatures were pretty nice, hitting 37 degrees with a decent 56.7dBA of noise generated. Load was 69 degrees at a loud 61.9dBA, with the higher power usage of this card bumping the temps up compared to the reference 5850 cooler.

ASUS has put an awesome amount of effort into the presentation of the card otherwise, with a cool black support bar across the top of the PCB matched by an excellent black coating that gives it a really expensive feel. The ends of the PCB are also slightly rounded, and there are no rough edges at all; functionally useless, but it does make the card feel really neat. Crossfire is a definite possibility via two nipples at the top of the card, while power needs are supplied via two connectors; one 6-pin and one 8-pin.

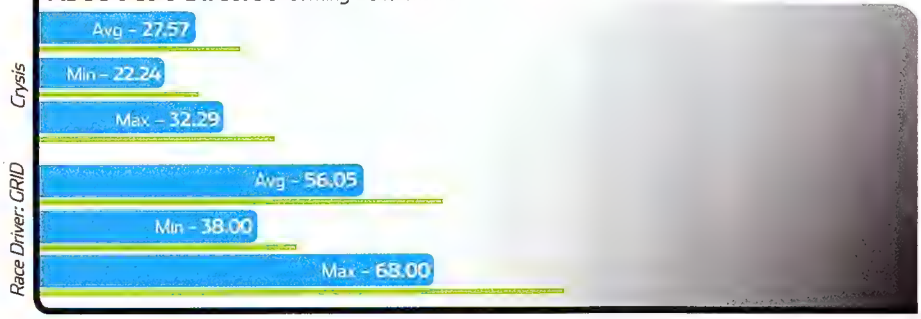
Performance in games was pretty good, with Crysis almost smoothly playable and GRID more than capable, matched by a nice 3DMark Vantage score. Heaven returned 15fps on our ultra-high settings, so while DX11 definitely stresses this tech it'll go great guns at lower settings. Unfortunately, there is no game included in the bundle.

Since ASUS went to the trouble of whacking on a better cooler, we went to the trouble of pushing it to within an inch of its life. Bumping up clockspeeds, we pushed harder than a chicken laying a watermelon-sized egg until we finished at our final speeds – 1000MHz on the core, representing a 200MHz increase! We also managed to bump up the memory speeds by ten per cent to 1100MHz, netting us a 3DMark Vantage score of P15980. This is impressive; and is only 900-odd points away from the performance of a 5870. With that in mind, the 5830 DirectCU is a great choice for the overclocker, though it commands a price premium over a faster-at-stock 5850. **JR**

ASUS 5830 DirectCU *Synthetic Benchmarks*



ASUS 5830 DirectCU *Gaming Benchmarks*



Performance Great overclocking, decent stock speed. 88

Bundle Not much at all. 65

Value A very nice card. 92

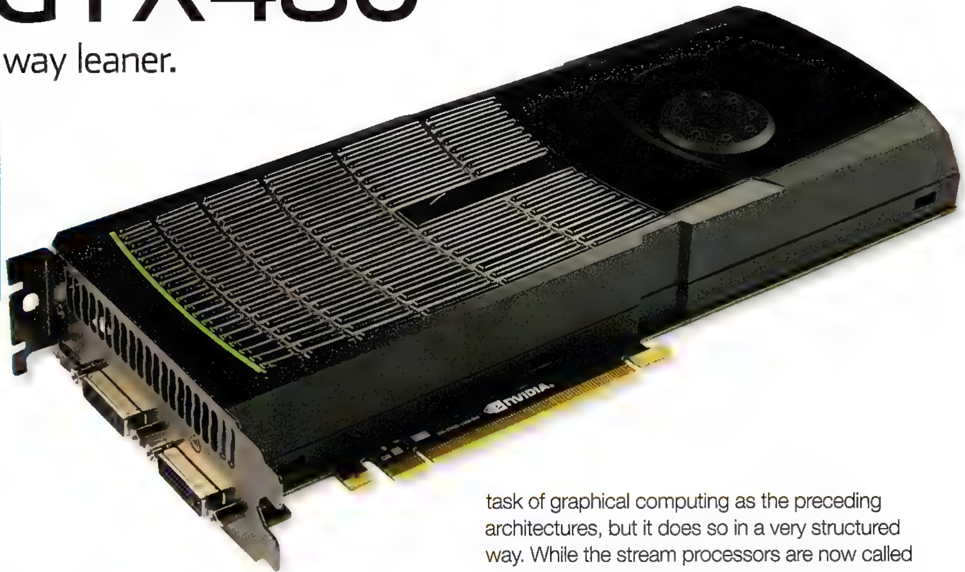
Build Great design touches. 89

Overall A card we'd be happy to recommend. 90%

NVIDIA GTX480

Greener and meaner; in no way leaner.

Street Price US$499 **Supplier** NVIDIA
Website www.nvidia.com
Specifications 700MHz core; 924MHz memory (3696MHz effective); 1401MHz shader; GF100 'Fermi' core; 480 CUDA Cores; 1.5GB GDDR5; 384-bit memory interface; dual slot PCB with active cooling; 6-pin, 8-pin power connector
Card info www.techpowerup.com/gpuz/3q7p

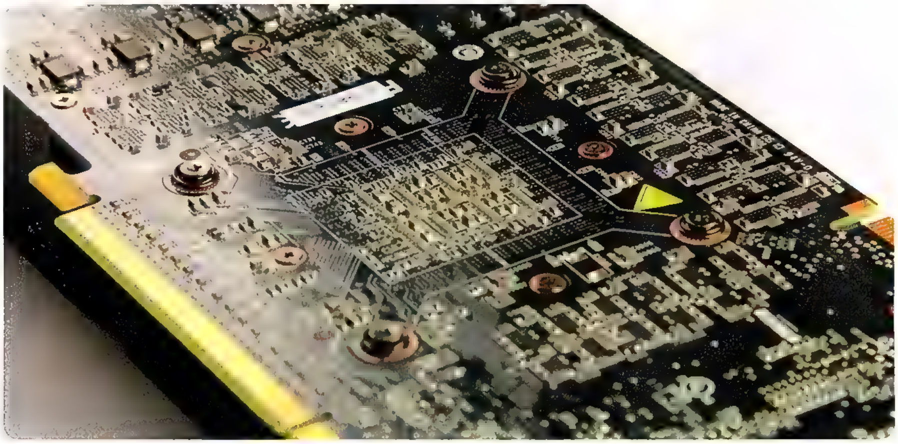


Six months is a long time in the computing world, and for many it can determine the difference between a clear winner, and the ultimate loser. Winning in this game means the strongest sales over twelve months or more; it means superiority of brand, and it pays to play on time. NVIDIA has tough competition in the form of ATI – who has been the leader in the market since September of 2009 – and NVIDIA's betting the farm on the GTX480 pulling them through this cycle of graphics tech. Will it be enough to slow the runaway freight train that is ATI?

Firming up Fermi

NVIDIA performed a flawless coup in November of 2006 with its 8800GTX graphics card, based around the G80 core that was manufactured on a relatively huge 90nm process. It boasted a small complement of 128 stream processors, and was revolutionary for entirely re-thinking how workloads were acted upon; removing the need for specialised hardware units, with each piece able to change its duties on-the-fly to meet demand.

The company built upon the success of the G80 core to bring about the G200; a core that almost doubled the processor count to 240, and shrunk the manufacturing process markedly to only 55nm. The GT200 saw use in the GTX285 and dual-chip GTX295, and though the manufacturing process had shrunk by 35nm, the transistor count more than doubled from 681 million to a whopping 1.4 billion. However, progress is very rarely static, and NVIDIA decided to take the new GF100 to a whole new level entirely – with a transistor count of three billion.



The raw power of the GF100 is undeniable: double the processing cores, full support for GDDR5 memory and a completely restructured core. However, there's more going on behind the scenes that isn't accounted for in the transistor count. Logic would otherwise dictate that 2.8 billion transistors should have made an appearance, but this clearly isn't the case. Manufacturing difficulties appear to have hindered yields of the GF100 with the full amount of processors, and considering the gigantic die size of 529mm^2, it isn't surprising to see the amount reduced. As each transistor is roughly the size of a chain of DNA, which is only 34nm long, the precision required is fantastically difficult to guarantee – especially when it's repeated three billion times. To find out where the extra transistors came from, we're going to delve deeper, into the very heart of the core itself.

Processing power

The GF100 core takes a similar approach to the task of graphical computing as the preceding architectures, but it does so in a very structured way. While the stream processors are now called CUDA Cores, their purpose has not changed, and there are 480 of them in use – sadly not the originally promised total of 512. They've been structured into explicit groupings, the highest level of which is called the Graphics Processing Cluster, or GPC.

There are four GPCs in the GF100 core, and each is an entirely self-contained ecosystem of processing components that can function individually; meaning that carving the core up to create lower-end models will be much easier. Inside each GPC resides a total of four large blocks called Streaming Multiprocessors, or SMs. These SMs each contain 32 CUDA Cores, the processors that do the actual calculation work, though it appears that a single SM in the GF100 is deactivated. The fifteen functional SMs add up to a total of 480 CUDA Cores.

However, the CUDA Cores themselves can break down further, with miniature support units adjacent to each Core that handle Floating Point and Integer tasks, as well as the Operand Collector; a unit that simulates a multi-port memory interface without the need for additional bandwidth, which essentially manages the memory usage of the Cores. The final important unit within an SM is the Polymorph Engine, a dedicated geometry pipeline that provides hardware acceleration for tessellation.

NVIDIA takes a very different tack with its support of tessellation, and by dedicating a chunk of each SM to it you get theoretically much better performance under heavy tessellated loads. Unlike ATI's design, which features a single powerful tessellator unit on each of the 5xxx series cores, NVIDIA's tessellation performance will scale up or down depending on the amount of Polymorph Engines.

To support the fifteen SMs, an external Raster Engine is paired up within each GPC for a total of four. This performs initial vector calculations with bit-accurate content, organising and structuring the workload of each SM to produce a final,

accurate image on the screen. There is 48KB of L1 cache within each SM, to give temporary workspace to hold data. To summarise the internal structure of the core so far:

`GF100 > GPC > 32 CUDA Cores > Polymorph Engine > [store in] L1 Cache`

External infrastructure

What we've covered until now is the horsepower behind the GF100 core, but all the speed in the world is useless without a way of controlling and directing it. Managing all the hardware units and functions is a daunting task, and it's also one that the GigaThread Engine is responsible for. Essentially identical in function to ATI's Command Processor, the GTE is a top-level manager that speaks directly with the PCIe interface, receiving the workload from the system and deciding what to do with it.

The system first sends data to the GTE, which stores it in the card's 1536MB of GDDR5 memory. Interfacing through a 384-bit memory bus, this huge amount of storage has a bandwidth of 173.3GB/s – 10.1GB/s faster than ATI's offering. The raw data is then piped from the GDDR5 to within the core, taking up residence in the gigantic central L2 cache. There is 819KB of L2 cache per SM, working as a high-speed framebuffer. The data stored in the L2 cache is eventually accessed by the L1 cache, where it will be worked through, and finally sent back into the L2 cache if needed later or used to assemble the final image.

> ... by dedicating a chunk of each SM to it you get theoretically much better performance under heavily tesselated loads.

This memory interface is essential for NVIDIA's most impressive change; the Dual Warp Scheduler. This unit takes the workload from the GigaThread Engine and re-organises it to be worked on in a highly parallel way – no longer will some cores be left idle while waiting for sequential workloads to finish. The Warp Scheduler instructs the CUDA Cores within each SM to perform all the work, including the DX11 features that are handled in the Polymorph Engine, and finally passes it onwards to be displayed on the screen. The entire process happens thousands of times every minute, from the initial request to the final output, and results in the image you see on the screen. To summarise:

`GTE > Retrieve data > Warp Scheduler > Processing [DX11] > Output`

Engineering challenges

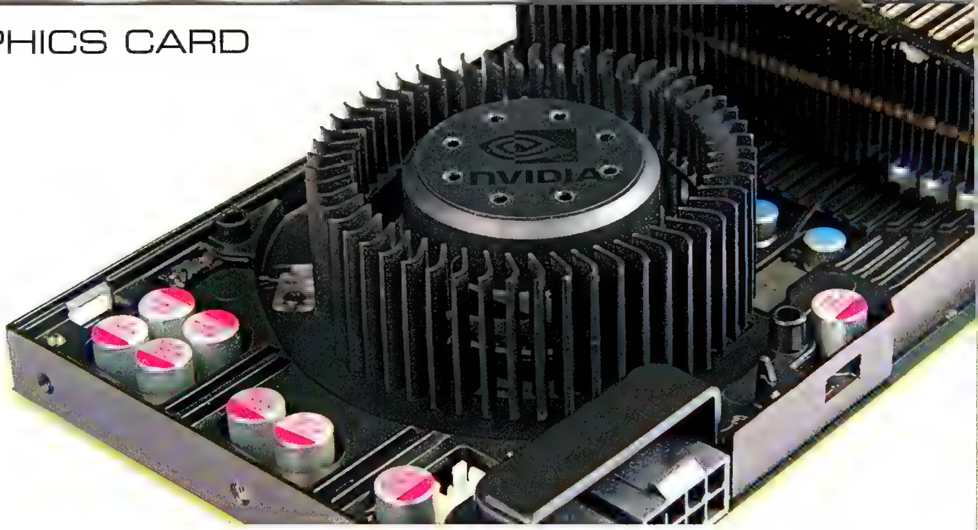
NVIDIA has not taken an elegant approach to the design of its GF100 core. The power consumption of the GT200 core sat at an already-high 204 Watts, and even though there has been a process shrink for GF100, its power consumption sits at a whopping 250 Watts. This is a direct result of the sheer amount of transistors in the core, and the flow-on effect of a gigantic die is managing to keep it cool.

As we saw online in our disassembly of the cooler (**www.atomicmpc.com.au/?170367**), the GTX480 is unlike any other design we've seen. Externally it appears to have the same features as competing high-end cards; a squirrel-cage intake fan, a plastic shroud to direct airflow, and a vented expansion bracket to exhaust hot air. The biggest change is visible on the front face of the card in plain sight. What looks to be chrome plating is actually the surface of the main heatsink that cools the GF100 core, and its construction appears to be predominantly nickel-plated aluminium or copper. Coupled to this huge surface area, over which a huge amount of heat can be radiated, there are also five heatpipes machined flat to directly contact the core. The GTX480's heat load is not to be taken lightly.

Indeed, the heat load of the card is nothing short of ridiculous. At idle, sitting in the open air without additional airflow as is the case with all other tests, the GTX480 sat at 48 degrees Celsius! The powerful Delta fan used in the cooler design was audible at idle, too, at the

Results comparison table (relative to GTX480)

	3DMark Vantage	Crysis Avg	Crysis Min	Crysis Max	Unigine Heaven FPS	Unigine Heaven Score	Unigine Heaven no tess FPS	Unigine no tess Heaven Score
GTX480	P20907	43.47	34.89	51.65	27.7	699	33.7	849
GTX285	P13405 (-36%)	29.9 (-31%)	24.89 (-29%)	34.54 (-33%)	NA	NA	23.5 (-30%)	592 (-30%)
HD5870	P18606 (-11%)	43.09 (-1%)	34.9 (0%)	49.54 (-0.04%)	24.6 (-11%)	619 (-11%)	34.5 (+2%)	869 (+2%)
HD5970	P22974 (+10%)	48.17 (+11%)	34.88 (0%)	64.09 (+24%)	35.9 (+27%)	905 (+29%)	48.5 (+44%)	1221 (+44%)



same 56.6dBA that most mid-range cards will peak at. Load was even worse: a roaring 68.6dBA of noise with an insane 94 degree temperature! The card took a full eight minutes of sitting at the desktop to even come back to idle temperatures!

Temperatures of a rig with two – or God forbid, three – of these cards are going to be huge, and even though SLI is possible with two nipples along the top of the card, it's going to require watercooling simply to deal with the heat density in any practicable way. Even idling with the Seasonic X-750 from this Issue caused the fan to spin up every minute, when the same load-activated fan never budged with a Crossfired 5970 and 5870 pair. NVIDIA hasn't released the official idle power specs for the GF100 core, and while we haven't tested it, it's clear that it's much higher than the ATI cards' combined usage.

The sheer power consumption of the GF100 alone means that a dual-core solution like the GTX295 will be an impossibility at the highest spec, seeing as the TDP would be roughly 500W – the PCIe spec limitation is 300W. As it stands, a single GTX480 requires a six and eight pin power cable, so the likelihood that they could pack two GF100 dies into a single card is slim. We may see limited runs of the GF100 with higher frequencies, or the full 512 CUDA Cores, but this is almost as far as the architecture can go.

A brave showing

To test the performance of the GTX480, we used five distinct benchmarks that each look at one aspect of what you'd expect to subject the card to. We tested it alongside the older GT200-based GTX285 card, as well as the current competition in the form of the six-month-old ATI 5870 and 5970 cards. NVIDIA was tested with the latest 197.17 drivers, while ATI was tested with 10.3.

The first benchmark off the rank is *3DMark Vantage*, a synthetic test that runs the card through its paces. Built predominantly on DirectX10, Vantage makes use of NVIDIA's proprietary PhysX library that can be GPU accelerated on NVIDIA cards, resulting in the 5870 losing out by 11 per cent. The older GTX285 is directly comparable however, and it loses out by a large 36 per cent, while the 5970 is the fastest.

Next up was *Crysis*, a DX10 game that set and held the standards for game visuals years ago. Perhaps the most telling comparison is that while the older GTX285 is 31 per cent slower than the GTX480, ATI's 5870 is *essentially identical in performance*. As there is no tessellation used whatsoever, neither of the competitors have an edge over the other; though the ATI card manages the test at a max heat of 79 degrees. The 5970 is again the clear winner, and also performs better than the GTX480 on temperatures, hitting only 80 degrees.

Unigine Heaven 1.0 was our third test, which consists of a DX11-based engine that features full tessellation support. It's also very configurable, so for this test we left these features on – which excluded the GTX285, as it only supports DX10. Here is where we see NVIDIA's Polymorph Engines come into play, taking the tessellation work in stride and giving a nice 27.7FPS with a final score of 699. ATI's 5870, with only a single tessellation unit, managed 11 per cent lower with only 24.6FPS and a score of 619. What this means is that in any game that features extensive tessellation, the GTX480 will be much more capable of running it with more eye candy or with smoother frames. Unfortunately, ATI's 5970 comes in even faster than NVIDIA's card with a great result of 35.9FPS and 905 points, beating NVIDIA by 29 per cent.

So we know that NVIDIA is very powerful when it comes to single-card tessellated workloads, but what about the same benchmark without tessellation? The story becomes much clearer here as we use the DX10 rendering path, with the older GTX285 again falling behind in performance by 30 per cent. The 5970 powers ahead of the crowd to nab 48.5FPS and a score of 1221 (some 44 per cent faster than the GTX480), but the real news here is that the 5870 beats the GTX480 by two per cent!

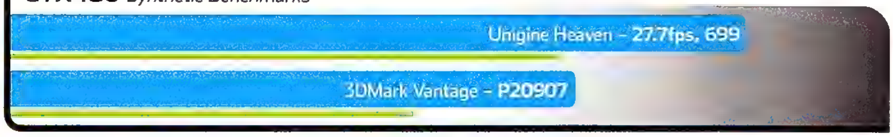
So where does it stand?

The benchmark results speak for themselves and it's clear that unless you're playing a game that predominantly features heavy tessellation, you'll get practically identical performance out of the GTX480 and the 5870. To boil the numbers down to a dollar-per-average frame in Crysis, the 5970 provides the most expensive frames at $19.82, though it also gives you the highest amount. A 5870 costs $525, and each frame is a very tempting $12.18.

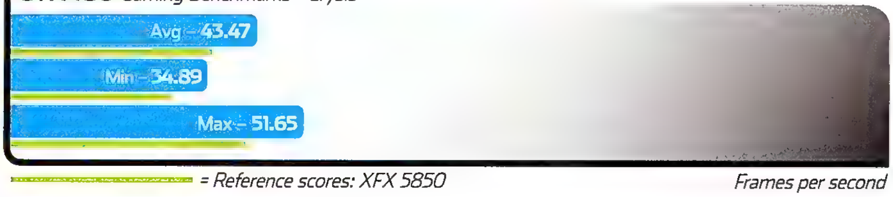
With an RRP of $US499 – roughly $600 with GST in a straight conversion – each frame costs $13.8, meaning that it comes in second place on the value stakes. While technologies such as PhysX, 3D VISION and CUDA are only available on NVIDIA's tech, ATI still has the clear winner even after having been on the market for six entire months, putting NVIDIA's GTX480 in an awkward position.

The GTX480 runs uncomfortably hot at times, but has support for NVIDIA's proprietary technologies. It costs $600... and we don't have a competing other thing to balance the scales with. The clear winner based on sheer value, heat, power consumption and noise is still the 5870 – and you gain almost no performance when using the GF100 instead. **JR**

GTX480 *Synthetic Benchmarks*



GTX480 *Gaming Benchmarks - Crysis*



Performance	Effectively identical to an ATI 5870.	93
Bundle		N/A
Value	Not bad, but it doesn't compete.	80
Build	Brute force attempt at design has failed.	55
Overall	An alternative for DX11, but not a huge improvement.	82%

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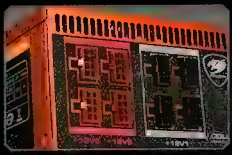
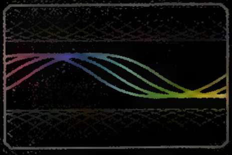

FLEXIBLE CABLE MANAGEMENT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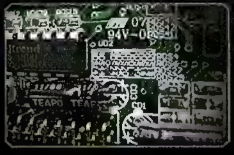
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Cougar S700

An alluring cougar with an alarming bite.

Street Price TBC **Supplier** FortuneTec
Website www.fortunetec.com.au
Specifications ATX form factor; 24-pin, 8-pin ATX, 6x molex, 8x SATA, 1x Floppy, 2x 8/6-pin PCIe, 2x 6-pin PCIe, 80+ Silver

When you think of a cougar, your mind probably jumps to older women preying on weak males. But this new brand, called Cougar, is nothing like this weird cultural phenomenon. Designed in Germany (though still built in Taiwan), the S700 is a 700W power supply rated to the 80 Plus Silver rating of up to 91 per cent, and offers enough cabling to keep any enthusiast system powered.

The cables themselves are very impressive, sheathed with a great nylon material and painted with orange/black/white stripes, much like a python. The unit itself is more appealing than an iceblock on a hot day, with a rough black shell mixing with smoothly painted orange, also sporting a large 135mm fan to keep temps under control. Impressively, the unit never became hot or even warm under load, exhausting cool air throughout all our testing and remaining unexpectedly quiet.

Power needs are supplied via four 12V rails, two at 20A and two at 24A, that give a total of 684W of 12V power. We loaded it up with an Intel i965 @ 3.6GHz (1.375V) and a 5890 Crossfired with a 5870. OCCT was run on the CPU while the Unigine Heaven benchmark ran on the cards, giving us a theoretical max 12V draw of these components of 638W.

At idle the 5V rail sat at 5.102V, barely wavering to 5.095V at load. However, the 12V rail sat at 12.276V idle – and once under stress, it dipped to 12.199...then kept falling to 11.835, 11.569 and even dipped as low as 11.4V. This is pretty atrocious, and is a hair away from breaking Intel spec. Keeping in mind that this load is pretty crazy though, the Cougar S700 will be a good choice for a single-card gaming rig – just don't aspire to Crossfire or SLI with it. **JR**

Overall
Not a bad unit, though the rail wavering is unsettling.
72%

Seasonic X-750

Completely modular, can be literally inaudible.

Street Price $245 **Supplier** PowerhousePC
Website www.powerhousepc.com.au
Specifications ATX form factor; 24-pin, 8-pin ATX, 8x molex, 8x SATA, 2x Floppy, 4x 8/6-pin PCIe, 80+ Gold

Seasonic has long held a reputation for producing great quality power supplies, and the X-750 certainly holds this up. Even just looking at the price suggests a level of quality that most manufacturers rarely reach – at $245, it's over $100 more expensive than competing brands at the same wattage, and amusingly there are even some 750W power supplies for sale at only $75 (most likely with the largest 5V rail you've ever seen!).

The X-750 is really in a class all its own though, and with an 80 Plus Gold certification thanks to the expensive components used within. It's not overly heavy, but certainly has a heft to it that you definitely want in a PSU – and the 100 per cent modular cables, ranging from the 24-pin all the way to the smallest molex cable are sure to impress. While they don't really all need to be modular, it can be handy in some cases, and certainly ain't gonna hurt it none.

Cooled by a large 120mm fan, this model is unique in that the fan will only actually start spinning when the PSU hits a certain temperature. While this is sometimes unsettling, it did kick in after about five minutes, and at desktop idle was completely still, resulting in absolutely no noise generation. As seen in the Cougar review above, the test settings gave the single 12V rail rated at 62A an idle reading of 12.124V that wavered slightly to 12.351V, but remained rock solid under load. The 5V rail was similarly impressive, moving from 5.023V to 5.020V.

The fan control is certainly impressive, though it did result in the PSU getting slightly warmer than usual – and when left idling overnight, it was pretty toasty all over. With pricing making matters somewhat awkward, we definitely recommend this PSU for a low-noise build, but gamers can just as easily look elsewhere for cheaper. **JR**

Overall
Very quiet, plenty of cables and power, but you'll pay for it.
93%

BenQ M2700HD

Not quite a screengasm.

Street Price $565 **Supplier** BenQ
Website www.benq.com.au

Specifications 27in widescreen; 16:9, 1920x1080; 400cd/m2; 2xHDMI, DVI, VGA, Component, Composite, S-Video; quad USB; remote control

Gigantic screens are something that most people would love to have, but rarely get around to buying due to their sheer size, and the M2700HD is no different. It's a 1080p-capable 27in panel with a decent 400cd/m2 brightness, that also packs in three digital HD inputs alongside two analogue HD, two analogue SD and a four-port USB hub. There's even a nifty little remote, though it's sadly limited to changing basic settings like inputs and brightness (and really, this is supposed to be a monitor, not TV).

Unfortunately, or perhaps as a result of, the gigantic screen looks quite small when framed by such a huge bezel. It also takes up much more real estate on a desk than really is practicable, relegating this further and further into TVland than we'd like. However, it's still not amazing as a TV either, with a very poor vertical viewing range.

Adding to this poor range is a standard colour configuration that blows out colours immensely; while the 'eco' mode gives it a sterile feel. We threw it under a custom mode and tweaked the panel a little, finally settling on an image that looked okay-ish, with nice colours but a terrible black level.

We fired up the official Avatar 1080p trailer, which looked quite vibrant once configured, though it was distractingly grainy from a typical desk-viewing distance. Cloudy with a Chance of Meatballs looked amazing, with the brightness of the screen giving weight to the colours, though the slow 5ms refresh rate did produce some tearing. The TRON VFX concept trailer looked terrible, and it's usually moody blacks looked muddied and gray with significant backlight bleed – though the colours were impressive.

For the price and input flexibility, the M2700HD is a decent budget choice if you're after a dual-purpose monitor and television, but for hardcore gaming or movie watching we'd suggest you steer clear. **JR**

Overall
A little lifeless, but easy to hook up with.

70%

SteelSeries Siberia V2

A great design, but not ideal sound.

Street Price $125 **Supplier** Steel Series
Website www.steelseries.com

Unlike many of the other headsets we've seen, the Siberia V2 doesn't have a solid headband. Instead it's held together by two wires. Because these are so flexible, the headphones are held firmly, but very gently on the side of your head.

The cups are comfortable too, featuring plenty of soft padding. The Siberia V2 has a fully retractable microphone, so it doesn't get in the way when you're not playing an online game. You can connect the Siberia V2 to your PC either through a pair of standard 3.5mm mini-jacks (headphone and microphone) or USB, in which case, a tiny sound card in the in-line volume control processes the audio signal.

The Siberia V2 makes a reasonable attempt at playing back music and soundtrack MP3s, although high-frequency noises such as cymbals sound a little too lively. However, whatever music we tried listening to, the Siberia V2 failed to excite, thanks to a shortage of bass. It's nowhere near as bad as some cheaper headphones, but it's annoying given the premium price.

This lack of bass also makes the Siberia V2 less-than-ideal when gaming, unless of course you spend most of your time playing chess sims. What's more, we noticed a small but distinct hiss in the background during quiet moments, which is something none of the other headsets suffered from.

Although the Siberia V2 is a very comfortable headset, the lacklustre sound reproduction makes it hard to recommend, unless sound is not the most important aspect of your gaming experience. And really, it's not something that you should skip! **JG**

Overall
Comfortable, but the audio reproduction is limited.

74%

Fractal Design Define R2 Black Pearl

A stealthy entry onto the PC case scene.

Street Price $159 **Supplier** Anyware
Website www.fractal-design.com
Specifications 207 x 440 x 521mm (W x H x D); 1x Fractal Design 120mm Silent Series 15dB fan (front), 1x Fractal Design 120mm Silent Series 15dB fan (rear); 8x 3.5in drive bays, 2x 5.25in drive bays; mITX, mATX and ATX; 12.5kg; metal and plastic case.
Gallery link www.atomicmpc.com.au/?168844

Right up front: the R2 Black Pearl is not a case that's going to be a great LAN gamer's choice. It's heavy, it's plain... and it's also pretty awesome.

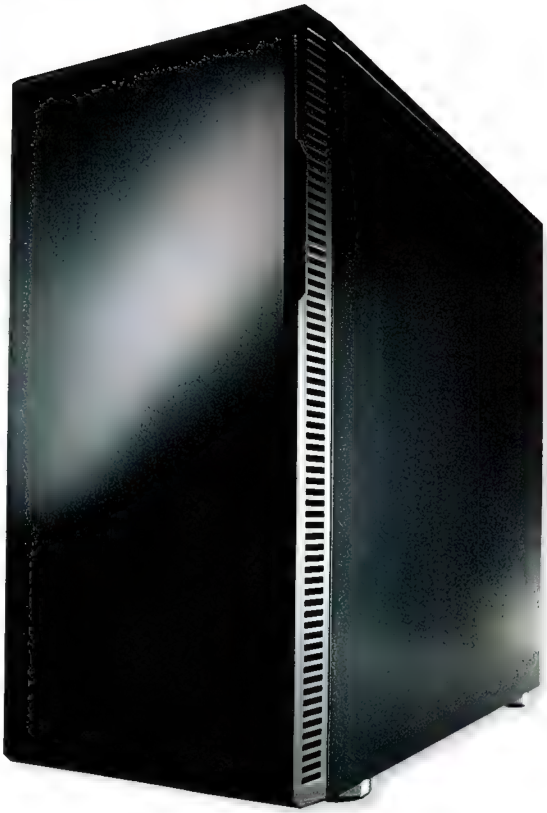
The exterior is enough to make you think that Fractal Design's been stealing blueprints off Antec – it's practically a Sonata knock-off, but don't for one minute let yourself believe that that means it's a cheap imitation. If anything, the R2 Black Pearl is a proud descendant of the Sonata, and an even greater proponent of quiet computing.

From the exterior, a front hinged fascia hides the Black Pearl's drive bays and front intake fan. It's a solid panel, with foam sound dampening material and feels good and heavy. There's only one front fan, but there's a mount for another, and both feature mesh covers and further hinged doors. Above front panel are the IO ports, and a very sound feeling power button. There's no easy reset button; it can be argued that that's far less important these days, but we still find them very handy.

From the exterior you'll also notice there's something blocking the case's side and upper fan mounts, and white expansion slot blanking plates at the rear of the case. Taking the side panel off reveals the secrets of both: one, there's a bitumen-based sound-dampening material pasted on both side-panel and upper panel, and the interior is stylishly coloured in black and white.

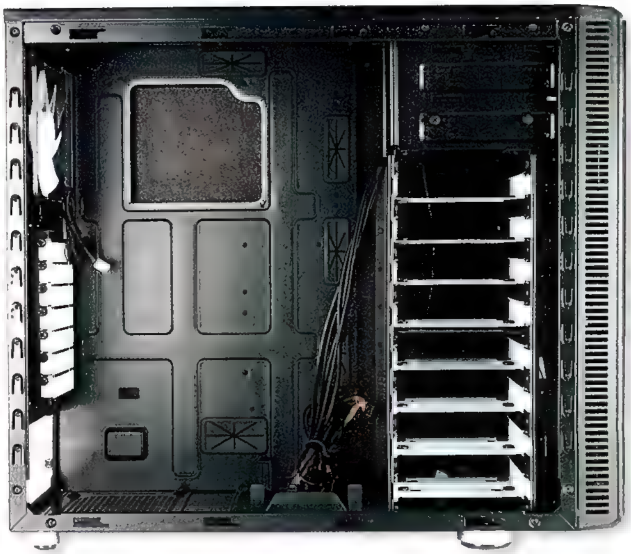
Yes, bitumen. Not quite the hot sticky stuff that coats road surfaces, but something related to it. This is where the case's weight comes from, but it's also a superb sound dampener. We've seen this case in a build before, and it really is an awesome choice for anyone who wants a quiet solution. The bitumen also adds a lot of structural strength, and best thing is that the panels over the fan intakes can be removed in case you do want to add more cooling. It seems a bit beside the point to us, but it's nice to have the option.

The interior itself is seriously just about the most stylish thing we've seen in a PC case. With white blanking plates, white fans and white HDD cages, all on a black interior, it's... well, pimpin'. It's also packed with clever touches. There are plastic and rubber grommeted cable runs all over the mobo plate, sound dampening all over the place (especially on the PSU mount), more rubber grommets on the HDD cages, plastic lining on the CPU cutout on the mobo-plate... it's pretty tricked



out. On top of that, the case is very sturdy, with almost no flex in the chassis.

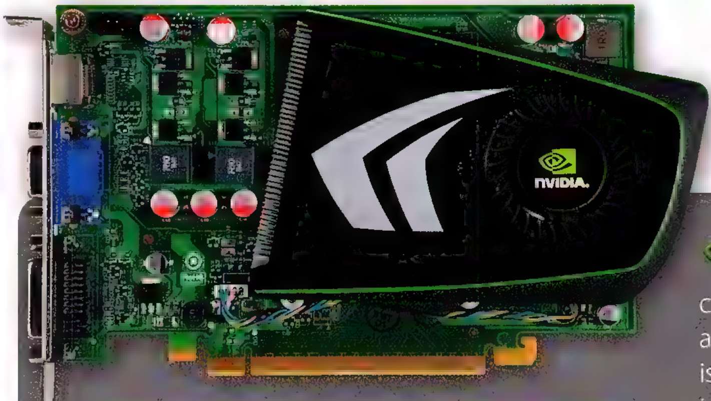
As it stands, this may not be the ideal case for some serious overclocking, but for quiet – and stylish – computing, there are few cases that can best it. **DH**



Build	Solid and vewy, vewy quiet.	90
Value	An excellent price.	92
Cooling	Not the coolest case, but more than adequate.	80
Features	Some great sound-proofing ideas and tool-less designs.	89
Overall	A great alternative to the Sonata, and hyper-stylish.	88%

Enjoy A Full Range Of Entertainment

NVIDIA GeForce GT 240



ECIFICATIONS

CORE CLOCK *550Mhz*	MEMORY *GDDR5*
MEMORY CLOCK *850Mhz*	PORTS *HDMI, DVI, D-Sub*

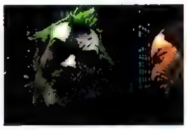
When it comes to enjoying truly outstanding visuals for 3D gaming, high-end graphics cards should definitely be the items of choice. Unfortunately for a lot of gamers, both hard-core and casual, the price premium is a little too much for a limited budget. To address this, NVIDIA introduces the GeForce GT240. Unlike the 9600 GT, its predecessor and direct competition in terms of hardware performance, the feature-rich and attractively priced GT 240 is in a whole new league of its own. It is a card made to cater to the needs of the budget-conscious gamer and enthusiast!

High Speed Efficiency

40nm Core And GDDR5 Memory For Outstanding Performance

The GT 240 is part of NVIDIA's mid-range line of graphics solutions, but while its specifications seem unassuming, belying this humble image is a beast waiting to be unleashed. Using a new 40nm core fabrication process, a smaller and more energy efficient chip can be manufactured and incorporated into the GT 240 allowing it to consume only 70W of power to operate, compared to the 135W power consumption of the 9600 GT. The new chip also runs cooler than older cores. Add to that some high-speed GDDR5 memory and you can expect performance levels that are leaps and bounds ahead of the competition! Without a doubt, the GT 240 is designed to give casual gamers a better gaming experience.

Reality On A Whole New Plane



Awesome Real Physics Effiicts With PhysX Acceleration

If you are a hard-core gamer, solutions, but while its then you must know what PhysiX is because it's the latest trend and the future of gaming! The GT 240 features full PhysX physics acceleration suppport to achieve greater realism with complex physics effects for wind, water flow, dust particles, and other physics effects that add up to further enhance the overall gaming experience. Soon, more and more gaming titles will be released incorporating this technology. With PhysX, gaming will never be the same again.

A Revolution In Gaming Performance

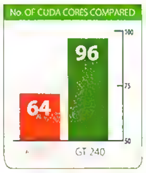
30 Is The Magic Number

To compete with the 9600 GT, the GT 240 put up a strong argument to convince gamers, and the points are quite satisfactory indeed. Whether it is in 3DMark Vantage or other benchmark game titles, the results are conclusive, particularly with FarCry 2 and Cryostasis where the GT 240 exhibits more than a 30% increase in performance over the 9600 GT. At the same time, it presented mind-blowing effects in Batman: Arkham Asylum. In total, the GT 240 is 30% better than the 9600GT thanks to the increase in the number of CUDA processors. Aside from its surprising capabilities, the 40nm manufacturing process also affords much lower power consumption and provides more headroom for overclockers to tinker with.

Effortless Conversions

Taking Full Advantage Of DirectCompute

More and more people are using mobile phones and portable game consoles to watch movies to pass the time. While handheld devices have become an intricate part of the modern entertainment lifestyle, what remains is the tedious process of converting video to different formats that continue to plague users with headaches. However, with the GT 240, these pains will be a thing of the past! With 96 CUDA cores combined with Windows 7, users will be able to take full advantage of DirectCompute decoding technology to rapidly re-encode high-definition content to a format usable in mobile devices, saving users time and a whole lot of effort.



A comparison on the number of CUDA Cores

Be it files for Internet sharing or viewing on handheld devices, file conversions can be done in an instant!

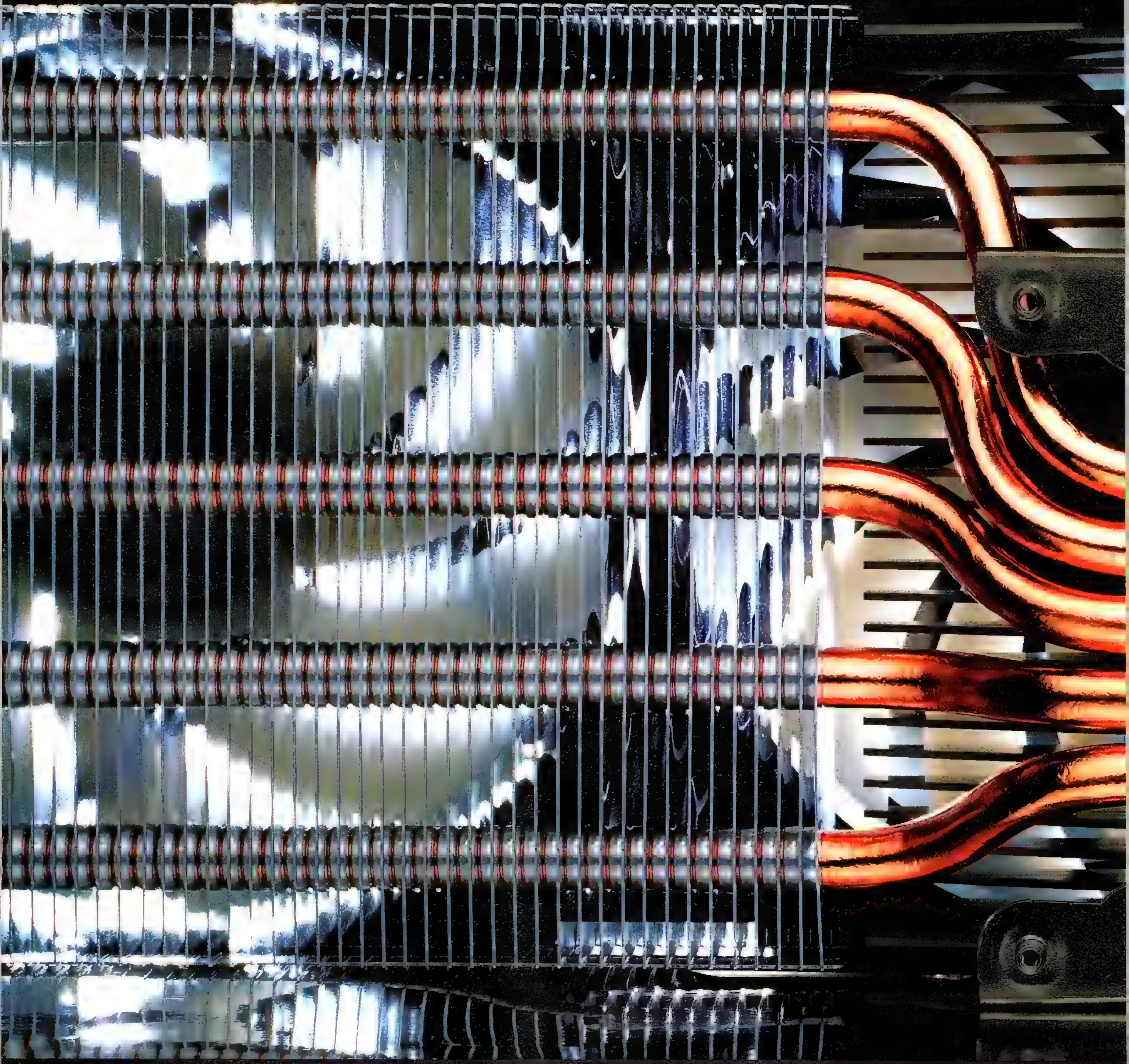
Seamless Compatibility

Enjoy The Latest Gaming Titles Without Delay

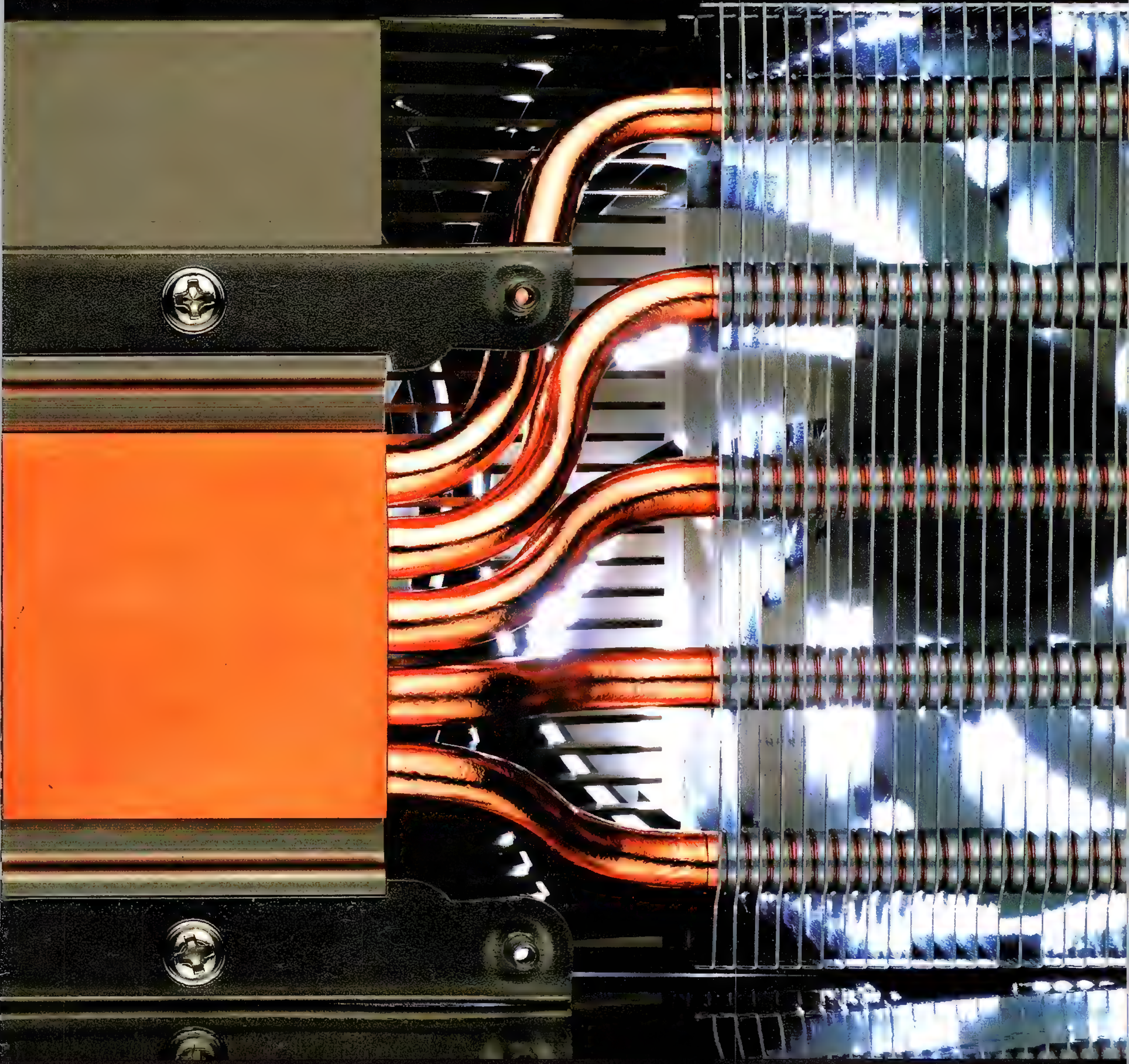
While the competition has already introduced a variety of new products that showcase a very noticeable growth in processing power, many find that full driver support for popular games such as batman: Arkham Asylum, Resident Evil 5, and other popular games are hard to come by. In contrast, for NVIDIA products, whether it is a GT 240 or any of the other GT 200 series of graphics cards, drivers ar always available and optimized to maximize the game itself and allow for a smoother gaming experience.

PhysX BENCHMARKS WINS!

TEST DATA	GeForce GT 240	GeForce 9600 GT	Advantage
3DMark Vantage Total			
Extreme	2088	1900	5.68%
High	3481	3172	9.74%
Performance	5714	5372	6.36%
Far Cry 2			
1920 x 1200 / all high	13.04	10.26	30.60%
Resident Evil 5			
1920 x 1200 / all high	40.9	38.5	6.23%
World In Conflict			
1920 x 1200 / all high	25	23	8.69%
Batman : Arkham Asylum			
1920 x 1200 / all high	36	33	9.09%
Nurien			
1920 x 1200 / all high	47.75	42.69	11.85%
Cryostasis			
1680 x 1050/high	18.6	9.8	89.79%
1440 x 900 / high	23.8	10.4	128.84%
Warmonger			
Driver Control : 1280 x 1024	57	42	35.71%
TOTAL			30.01%



GRAPHICS CARD COOLERS



Graphics cards are often the noisiest components in a PC. ATI's HD 4000-series and Nvidia's GTX 200-series hardware in particular have seen people reach for waterblocks in their thousands in an attempt to quieten their PCs, lower the graphics card's operating temperatures and obtain more overclocking headroom.

ATI's HD 5000-series runs much cooler and quieter than the HD 4000-series, but this hasn't prevented third-party graphics card cooler manufacturers from scrambling to produce coolers that support the new king of the hill. The question is whether or not these new coolers can help to lower the temperature and noise of your graphics card. We've taken 12 of the latest third-party coolers and pitted them against the stock coolers of the HD 4890, HD 5870 and the GTX 280 to determine if there's a cheaper and easier alternative to water cooling.

Antony Leather and James Gorbold

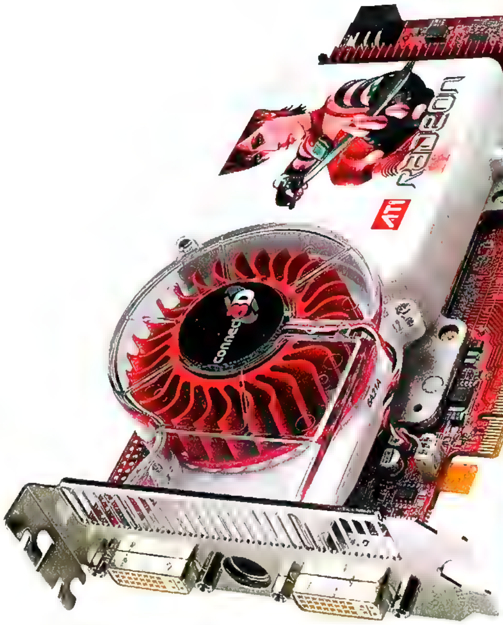
How to remove the cooler from your graphics card

Thinking of replacing your stock cooler with a superior and quieter model, but scared of damaging your hardware? **Antony Leather** shows you how it's done.

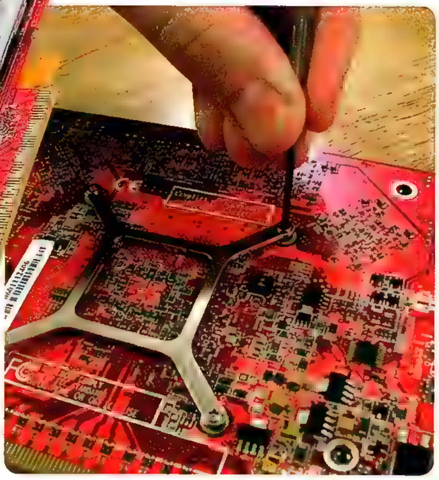
Removing a GPU cooler

What you need

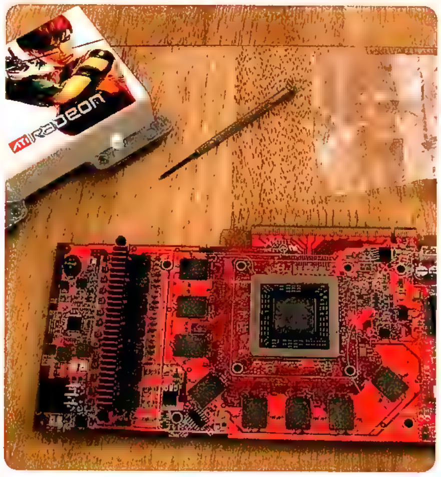
- Set of small precision-type screwdrivers
- Pliers
- TIM Cleaner, such as ArtiClean (available online)



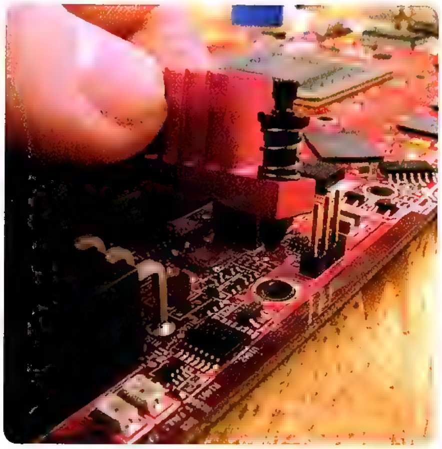
1 High-end graphics cards have large coolers that are held in place by dozens of small screws. They can be fiddly to remove, but aftermarket coolers, such as those we review in this test, offer better performance with lower noise levels.



2 Start by laying your graphics card on a flat surface. Remove the four main screws on the back of the cooler – these hold it in place over the GPU core. They're usually larger and more obvious than the other screws on the heatsink, and often have a square bracket around them.

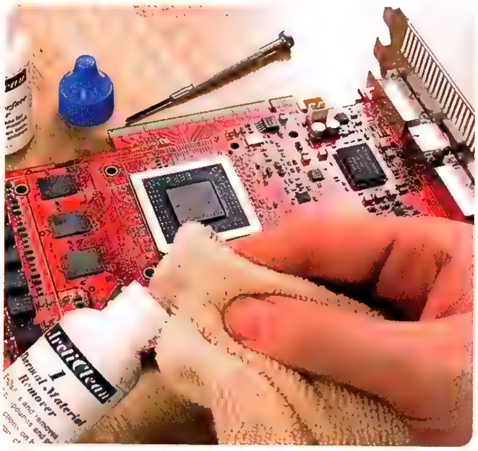


3 Continue unscrewing all the screws that hold the cooler in place around the PCB. After that, disconnect the fan power cable and gently lift the cooler away from the GPU. With the cooler facing upwards, you should be able to easily lift it off the graphics card.



4 If you intend to use a full-cover cooler or waterblock, it may cool the MOSFETs as well as the GPU and memory. If this is the case, you'll also need to remove any stock heatsinks that cool these.

5 Collect all the screws and thermal pads if there are any, and put them in a sealed bag. Store this in a safe place, so that you can sell the card in its original condition at a later date.



6 Finally, clean the core and memory chips with a lint-free cloth and TIM cleaner, such as Arctic Silver ArctiClean, and apply new TIM. When installing a new cooler, apply a ceramic-based non-conductive TIM, such as Arctic Silver Ceramique; it'll help the cooler work efficiently, and stray or spilled TIM won't do any damage.

How We Test

As with CPU coolers, the single most important factor to consider with graphics card coolers is how well they cool your graphics card. In addition to the GPU core, the RAM and VRMs on the PCB also become very hot under load. If they overheat, your PC will crash and the card might even die.

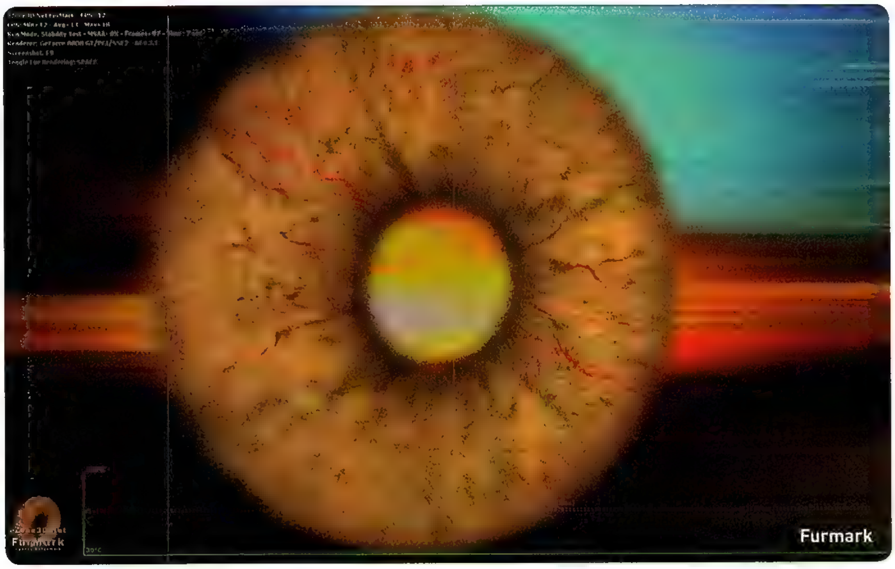
To measure the core temperature of the graphics card on test, we used GPU-Z (www.techpowerup.com/downloads/SysInfo/GPU-Z) and a multimeter to measure the ambient air temperature at the intakes of the Antec Nine Hundred Two case we used for testing. As we don't test in a temperature-controlled lab, we measured the difference between the ambient air temperature and the absolute temperature recorded by GPU-Z. The difference is called the delta T, and allows a comparison to be made between results if the ambient temperature fluctuates. For example, the temperature on one day may be several degrees lower than on another, which means that the results will likely be lower too. Using a delta T is the fairest way to compare results outside of a temperature-controlled lab.

As all graphics cards are equipped with a stock cooler, we also tested this in the same way to gauge how well the third-party coolers work in terms of both cooling and noise reduction, as the graphics card is often the noisiest component in a PC.

As graphics cards vary in shape, size and PCB layout, most third-party coolers are only compatible with a specific range of cards. To provide an even playing field, each cooler was tested on the graphics card with the highest TDP it supports. As such, testing was carried out on a Radeon HD 4890, Radeon HD 5870 and GeForce GTX 280.

We recorded the idle GPU temperature ten minutes after the computer had booted. We then used FurMark (www.ozone3d.net/benchmarks/fur) to tax the GPU. FurMark is an intensive OpenGL benchmark that uses fur-rendering algorithms to measure the performance of the graphics card. It provides a worst-case scenario to test if a graphics card cooler is able to cope with the GPU at maximum load. However, as FurMark doesn't stress a graphics card's memory as much as a game, we also ran a ten-minute loop of a Crysis timedemo in order to make sure that the memory was being sufficiently taxed.

Our test system also included an Intel Core 2 Quad Q6600 cooled using a Cooler Master Hyper TX2 cooler, a Foxconn P45A-S motherboard, 2GB of Corsair DDR2 memory, a 320GB Western Digital hard disk, an Antec TruePower New TP-650 PSU and an Antec Nine Hundred Two case. Testing was carried out with the side panel attached and with all the case fans set to low speed. We used Windows 7 64-bit, GPU-Z v0.3.8, FurMark v1.8.0 and Crysis patched to version 1.2.1.



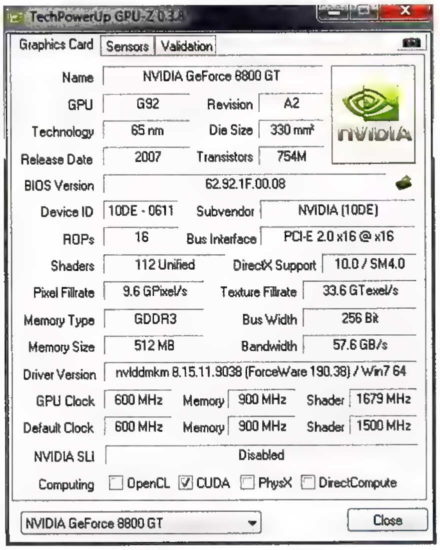
SCORING

For each review, we used three separate scores for Cooling, Design and Value, that gave us the Overall score. The Cooling score represents the ability of each cooler compared with the stock cooler, which scored an arbitrary 50 per cent. In addition to the GPU core temperature, we also considered whether or not the cooler can effectively cool the RAM and VRMs. For example, if the cooler includes heatsinks or directs airflow to these areas, it was awarded additional points.

The Design score takes into account factors such as how easy the cooler is to fit, how much space it takes up in terms of the number of expansion slots and also its noise level. Again, these are in relation to the stock cooler. The Value score considers the ratio of the Cooling and Design scores in relation to the price of the cooler.

For example, although a cooler may be cheap, if it's very loud or doesn't cool very well then its value score will be low. Likewise, even if a cooler is more expensive than others on test but does its job exceptionally well then it deserves a good Value score.

Finally, the Overall score is a calculation based on the sum of the previous three scores. These are all weighted by cooling ability, as this is the primary concern for these types of products. As such, this receives the highest weighting, with a total of 40 points, while Design and Value each receive 30 points.



Name: NVIDIA GeForce 8800 GT
GPU: G92
Revision: A2
Technology: 65 nm
Die Size: 330 mm²
Release Date: 2007
Transistors: 754M
BIOS Version: 62.92.1F.00.08
Device ID: 10DE - 0611
Subvendor: NVIDIA (10DE)
ROPs: 16
Bus Interface: PCI-E 2.0 x16 @ x16
Shaders: 112 Unified
DirectX Support: 10.0 / SM4.0
Pixel Fillrate: 9.6 GPixel/s
Texture Fillrate: 33.6 GTexel/s
Memory Type: GDDR3
Bus Width: 256 Bit
Memory Size: 512 MB
Bandwidth: 57.6 GB/s
Driver Version: nvlddmkm 8.15.11.9038 (ForceWare 190.38) / Win7 64
GPU Clock: 600 MHz Memory: 900 MHz Shader: 1679 MHz
Default Clock: 600 MHz Memory: 900 MHz Shader: 1500 MHz
NVIDIA SLI: Disabled
Computing: ☐ OpenCL ☑ CUDA ☐ PhysX ☐ DirectCompute
NVIDIA GeForce 8800 GT

The all new Centurion 5 II has been vastly improved from the inside. This mid-tower chassis is designed with increased drive bay capacity, more airflow thanks to the enhanced ventilation and fan options and easy-to-install features. This is a multi-purpose chassis that you cannot go wrong with.

Bottom PSU placement

1.8"/ 2.5"HDD adapter

CPU retaining hole

Airflow improvement

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	MSY Technology	02 9648 4116	www.msy.com.au
SA	Adrenalin Computers & Software	08 8410 0777	www.adrenalin.net.au
	IT4US Computers & Media	08 8231 7588	www.itforus.com.au
QLD	Computer Alliance	07 3421 3200	www.computeralliance.com.au
	Game Dude Computers	07 3387 1500	www.gamedude.com.au
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	MSY Technology	08 9344 1002	www.msy.com.au
	YNOT Computer Systems	08 9330 7666	www.ycs.net.au
	Netplus Micro Computers	08 9242 7288	www.netplus.com.au

Scythe Musashi

A solid performer, but there are more effective, quieter coolers available.

Street Price $133
Tested with ATI 5870

At first glance the slender Musashi appears to be too insubstantial to cope with the power output of a high-end graphics card. However, the fins in the heatsink are plentiful and there are four heatpipes to transfer heat away from the contact plate, despite it being the same height as the stock ATI cooler.

Two Scythe 100mm SY1012SL12VM fans powered by 3-pin fan connectors are included. These are similar to Scythe's skinny Kaze Jyu Slim 100mm case fans, which we have found to be lacking compared with the 92mm fans that the company also makes. Still, there are two, and as they're 12mm thick the cooler only takes up two expansion slots. The speed of each fan is individually controllable via a rheostat on an expansion slot blanking plate.

As the Musashi isn't compatible with the GTX 280, we tested it on the 5870. Installation was a challenge, as there are no instructions for this graphics card. However, it's fairly obvious where to place the various heatsinks for the RAM and VRMs, both of which are cooled by the fans above the PCB. Mounting the heatsink on the PCB wasn't as bad as it has been with other coolers. A backplate is included to reduce PCB warp, while nuts secure the pins that pass through the PCB lock, ensuring an even mount.

The fans were relatively quiet at full speed, managing a delta T of 46°C at load – 19°C below the stock cooler in FurMark. However, this temperature was much higher than the Thermalright T-Rad2. With the fans on low speed, the load delta T rose to 59°C, which was 6°C below the stock cooler, although the Musashi was inaudible even with the side panel removed.

The Musashi offers much better cooling than the stock HD 5870 cooler; it's also quieter (just) at full speed and therefore definitely worth considering, especially as it occupies no more space than the stock cooler. However, you do pay a premium for the privilege. **AL**

Overall
Not a bad heatsink, though hard to source and expensive.
75%

Scythe Setsugen

A great upgrade that will make your graphics card much cooler and quieter.

Street Price $85
Tested with ATI 5870

The Setsugen looks very different to Scythe's other cooler on test, the Musashi, although both HSFs cost a lot of money. The Setsugen is compatible with single-GPU Nvidia GTX 200-series, ATI HD 4000-series and HD 5000-series cards.

A single integrated Slipstream 120mm SV1212SL12H-V fan is located underneath the heatsinks and draws air away from the PCB instead of pulling it towards it, which is perhaps a disadvantage.

Like the fans on the Musashi, the Setsugen's single fan is powered by a 3-pin connector and can be controlled via a backplate-mounted rheostat, although this seems rather pointless, as it's quiet even at full speed.

Despite its large fan, the Setsugen takes up no more space than the stock coolers.

Installation was nearly identical to that of the Musashi too, although the instructions could be clearer. However, the procedure was fairly straightforward and the locking nuts allowed for an even mount once we'd dealt with the annoying heatsinks for the RAM and VRMs.

Running FurMark with the fan at full speed, the Setsugen provided a load delta T of 38°C, which is one of the best results on test, and an inspiring 27°C lower than the stock HD 5870 cooler. At low fan speed, the load delta T rose to 54°C. This is still a vast improvement over the stock cooler, and the fan remained incredibly quiet. It also passed our Crysis test with no problems.

The Setsugen also gave the GTX 280 a sound thrashing, managing a delta T of 50°C with its fan at full speed, and it was quite impressive. At low speed, the delta T rose to 56°C, which was slightly warmer than the Thermalright HR-03 GTX. Crysis again proved to be no problem.

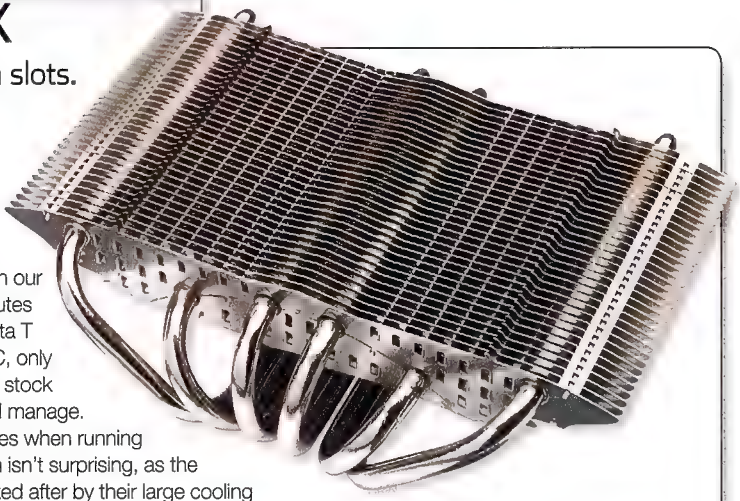
The Setsugen has manual fan speed control, is much easier to mount than many competing heatsinks, though is noticeably pricier. Sourcing one of these locally will definitely prove to be a challenge. It also takes up no more space than the either the ATI or Nvidia stock cooler. **AL**

Overall
Hard to find, but worth the effort of searching.
83%

Thermalright HR-03 GTX

Expensive and takes up far too many expansion slots.

Street Price $70
Tested with NVIDIA GTX280



The HR-03 GTX is the only Thermalright cooler in this Labs test that doesn't require you to search through compatibility tables to find a compatible VRM heatsink. This is probably because it's only compatible with single-GPU GTX 200-series graphics cards and includes everything you need – bar a fan.

The heatsink isn't massive, although it's slightly taller than the stock cooler, even without a fan mounted. If you're concerned about airflow, then you'll need to leave five expansion card slots free for the HR-03 GTX, which is quite frankly ridiculous. You'll also need to buy your own 120mm fan; a high-quality fan such as a Noctua NF-P12, which we used for our testing, costs around $30. Installing the HR-03 GTX was relatively simple, although the RAM heatsinks came off when we mounted the main heatsink on the PCB, due to it warping during the process.

After remounting the RAM heatsinks, we were ready to begin our tests. After 15 minutes of FurMark, the delta T topped out at 55°C, only 8°C lower than the stock Nvidia cooler could manage. There were no issues when running Crysis either, which isn't surprising, as the VRMs are well looked after by their large cooling plate and the residual airflow from the fan.

The Noctua NF-P12 is one of the quietest fans we've used, so something with a little more airflow and static air pressure might cope with the HR-03 GTX a little better. However, as noise reduction is a major reason for changing your graphics card's cooler, you wouldn't always want to install a very powerful fan.

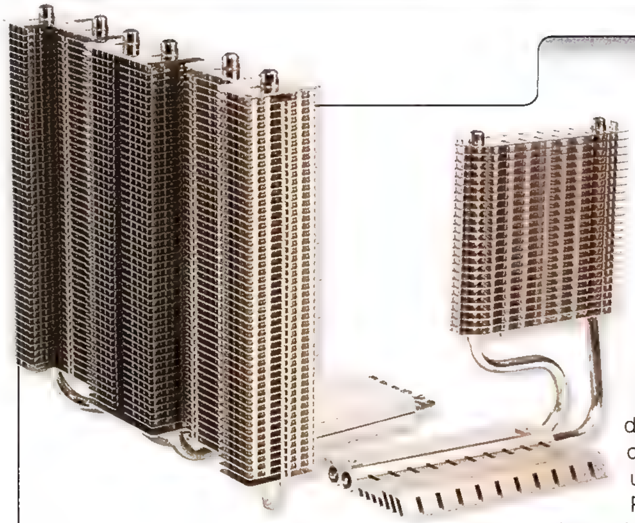
Although the Thermalright HR-03 GTX is a capable performer, the Scythe Setsugen is a better buy; it includes a good fan and takes up fewer expansion slots. **AL**

Overall
Alternatively, buy a Delta fan and call it done.
54%

Thermalright Spitfire

Doesn't live up to the standard of its famous namesake.

Street Price $90
Tested with ATI 4890



Thermalright coolers have traditionally been a little pricey, and the Spitfire is certainly no exception. The heatsink alone costs $90, on top of which you'll also need to buy an additional VRM-R2 heatsink for the VRMs. With a fan added, you'll be hard-pressed to get much change from $150.

The additional heatsink for the HD 5870 wasn't available at the time of writing, so we were left with no option but to test it on an HD 4980, with which we used the VRM-R2 heatsink. Unfortunately, Thermalright's crazy pricing is outdone by its baffling design. It's designed to sit on the GPU core with the heatsink pointing upwards or downwards. Pointing it upwards means that you're limited to using a very small (and noisy) CPU cooler, while pointing it downwards obstructed the PSU even with the Spitfire installed in the gargantuan Antec Twelve Hundred case.

The Spitfire is far from easy to install too, with the giant heatsink working against us when we tried to deal with its fiddly mounting mechanism. A mountain of heatsinks were included, several of which kept falling off. Gravity is such an issue with this huge cooler that it needs its own scaffolding in the form of metal rods that support it from mounts on the motherboard tray.

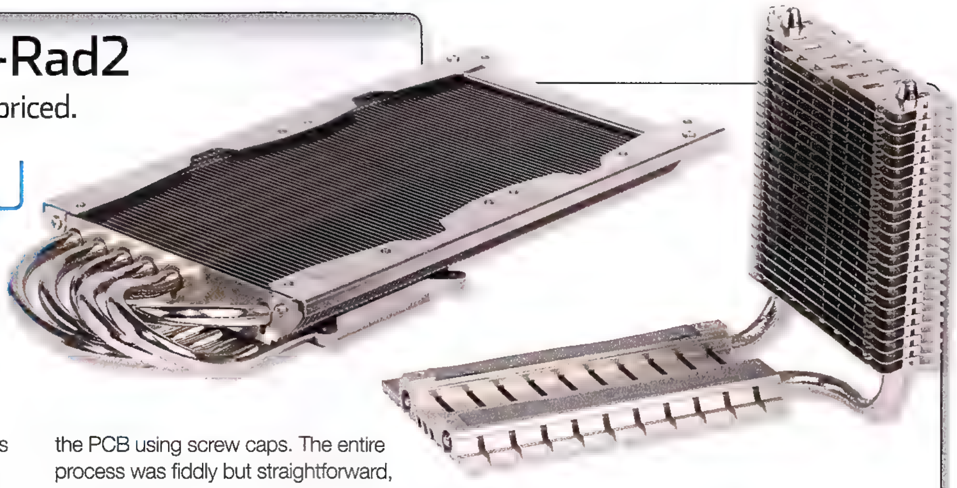
The Spitfire proved to be worse at cooling than the reference HD 4890 cooler, managing a load delta T of 53°C using a very quiet 120mm fan. The poor cooling ability is the final nail in the coffin for this frankly terrible heatsink. Unless you have a fetish for overpriced, oversized products that are hard to install and don't do a good job then the Spitfire should be avoided at all costs. **AL**

Overall
Not even a good fan can save this heatsink.
21%

Thermalright T-Rad2

Fantastic cooling, but it's overpriced.

Street Price $80
Tested with ATI 5870



As with the Spitfire, the T-Rad2 requires an additional VRM heatsink when used with many of the AMD graphics cards with which it's compatible. As you also need to buy either two 92mm fans or a single 120mm fan, you'll be lucky to see any change from a few hundred bucks. This cooler isn't compatible with Nvidia's GTX 200-series cards, so we decided to find out how it performs on an ATI HD 5870 with the VRM-R3 heatsink, itself an extra $45.

Even with a 120mm fan attached, the T-Rad2 only takes up three expansion slots – a lot fewer than many of the other coolers reviewed in this month's Labs test. Despite its slim design, Thermalright has managed to squeeze in six heatpipes.

Installation was similar to that of the HR-03 GTX, only instead of a VRM cooling plate, you have to contend with the VRM-R3 heatsink. The main heatsink is secured using four pins held in place from the other side of the PCB using screw caps. The entire process was fiddly but straightforward, and thankfully, the RAM heatsinks stayed attached long enough for us to complete our testing.

Using a single 120mm fan, we saw a delta T of 38°C. This is on a par with the Scythe Setsugen and a massive 27°C lower than the reference HD 5870 cooler. Our Crysis benchmark also ran from start to finish without any hiccups.

While the T-Rad2 oozes quality and offers great cooling ability, it's a lot more expensive than the Scythe Setsugen once you total up the cost of the VRM heatsink and fan(s). What's more, you could buy a full-cover HD 5870 waterblock for the same price as a fully equipped T-Rad2. For this reason, despite its good cooling and relatively easy installation, we can't recommend the T-Rad2. **AL**

Overall
Great performance, but price holds it back.
71%

KITLOG
Issue 3, March 2010
atomic
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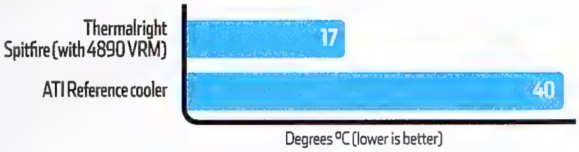
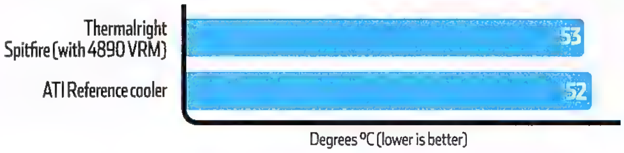
Feature Table

	Scythe Musashi	Scythe Setsugen	Thermalright HR-03 GTX	Thermalright Spitfire (with VRM-R2 heatsink)	Thermalright T-Rad2
Compatibility					
ATI Radeon HD	5800-series, 4800 series (single GPU only), 3800-series	5000-series, 4000-series, (single GPU only), 3800-series	✗	5000 series (requires VRM-R5 heatsink), 4890 and 4870 (requires VRM-R2 heatsink) 4850 and 4830 (single GPU only)	5000-series (requires VRM R3 or R4 heatsink), 4890 and 4870 (requires VRM-R1 or R2 heatsinks) 4850 and 4830 (single GPU only)
Nvidia GeForce	GTS 250	GTX 200-series (single GPU only)	GTX 200-series (single GPU only)	GTS 250 (with PWM heatsink)	GTS 250
Specification					
Heatsink material	Aluminium	Aluminium	Aluminium	Aluminium	Aluminium
Fans (included)	2 x 100mm (Y)	1 x 120mm (Y)	120mm (N)	120mm (N)	2 x 92mm or 1 x 120mm (N)
Fan speed control (method)	Y (PCI expansion slot dials)	Y (PCI expansion slot dial)	✗	✗	✗
Stated noise (dBA)	12.5-29.2	19.5-33.6	N/A	N/A	N/A
Power connector	4-pin Molex	3-pin	✗	✗	✗
Total expansion slots used when attached to PCB	2	2	3 (without fan)	2 (without fan)	2 (without fan)
Dimensions (mm) (W x D x H)	250 x 104 x 35	180 x 139 x 33	133 x 156 x 38 (without fan)	147 x 123 x 154 (without fan)	228 x 104 x 24 (without fan)
Cooling					
RAM	4 (heatsinks)	4 (heatsinks)	4 (heatsinks)	4 (heatsinks)	4 (heatsinks)
VRMs	4 (heatsinks)	4 (heatsinks)	4 (single cooling plate)	4 (requires additional heatsink)	4 (requires additional heatsink)

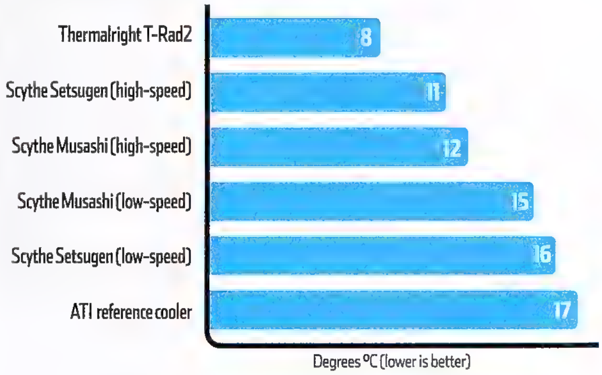
ATI Radeon HD 4890 delta T (idle)



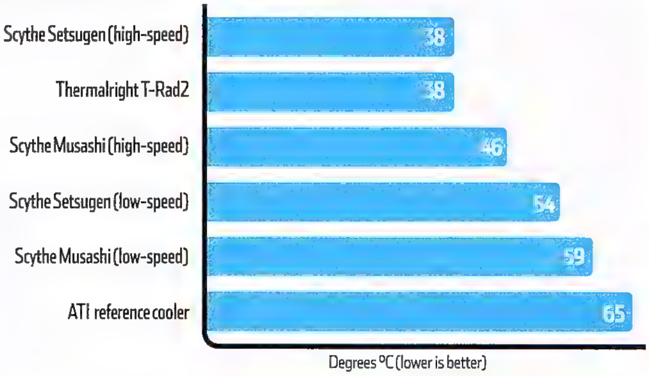
ATI Radeon HD 4890 delta T (load)



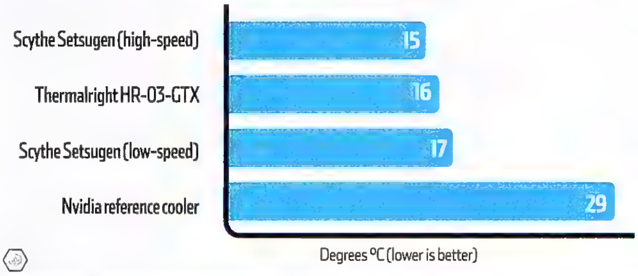
ATI Radeon HD 5870 delta T (idle)



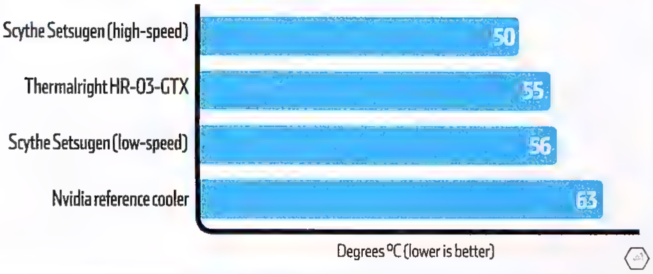
ATI Radeon HD 5870 delta T (load)



Nvidia GeForce GTX 280 delta T (idle)



Nvidia GeForce GTX 280 delta T (load)



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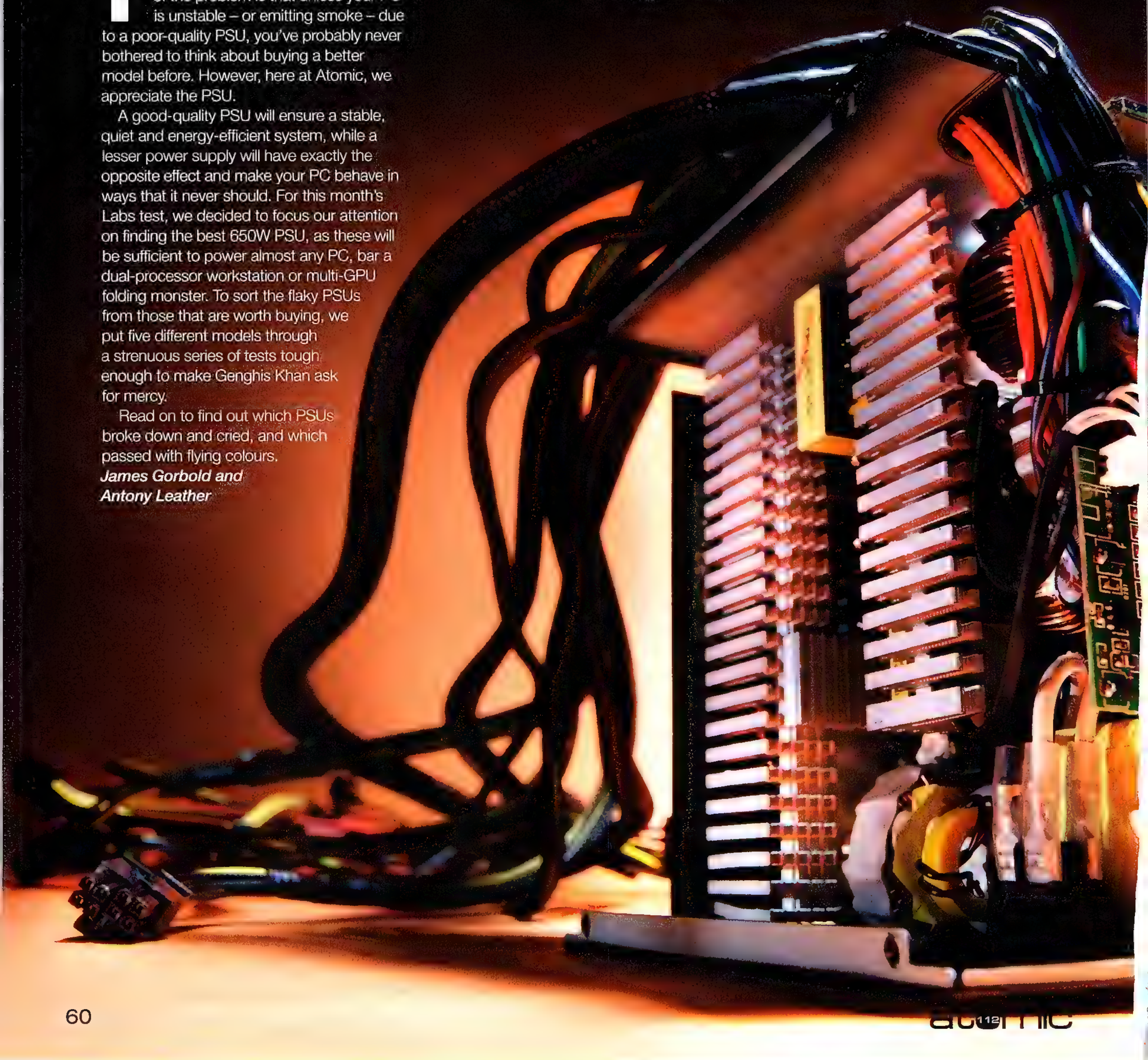
MID-RANGE Power Supplies

The humble PSU is arguably the most overlooked component in any PC. Part of the problem is that unless your PC is unstable – or emitting smoke – due to a poor-quality PSU, you've probably never bothered to think about buying a better model before. However, here at Atomic, we appreciate the PSU.

A good-quality PSU will ensure a stable, quiet and energy-efficient system, while a lesser power supply will have exactly the opposite effect and make your PC behave in ways that it never should. For this month's Labs test, we decided to focus our attention on finding the best 650W PSU, as these will be sufficient to power almost any PC, bar a dual-processor workstation or multi-GPU folding monster. To sort the flaky PSUs from those that are worth buying, we put five different models through a strenuous series of tests tough enough to make Genghis Khan ask for mercy.

Read on to find out which PSUs broke down and cried, and which passed with flying colours.

James Gorbold and Antony Leather

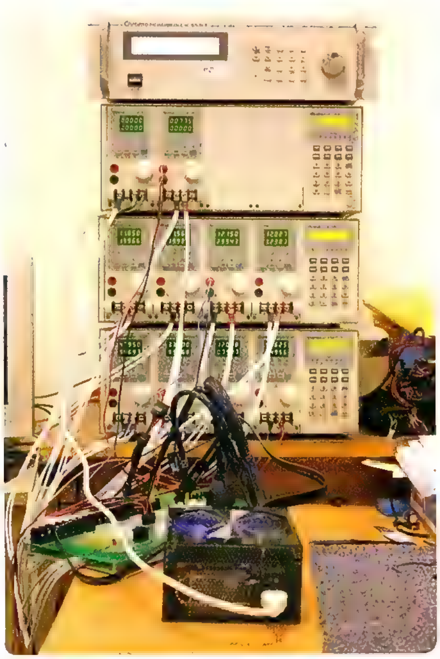


How We Test

As PSU test equipment is highly specialised, we use a third-party lab – with some seriously stressful hardware – to conduct our tests. This enables us to use the latest generation of PSU testing equipment. By using the combination of a Chroma 6314 load tester and Chroma 61604 power supply, we were able to measure the voltage stability, overall efficiency and PFC efficiency of each PSU.

To test each PSU, we programmed the load testers to drain the amount of power that each manufacturer claims its PSU can deliver. We measured the voltage of each rail at 50 and 100 per cent load to determine if it was within the ATX spec. We then left each PSU running at 100 per cent load for 30 minutes to determine whether it could produce stable voltages over an extended period.

An area of increasing interest is the overall efficiency of the PSU, or how much power it draws from the mains to supply the requested load. Efficiency is very important because any wasted energy is dissipated as heat. This must then be expelled by the cooling system, otherwise the electronic components inside the PSU will become less effective and the PSU might even burn out. For example, many PSUs can only provide their claimed output at temperatures between 25°C and 40°C; if they become any hotter, their output drops. This means that a less efficient PSU requires a more powerful and noisy cooling system. An efficient PSU, on the other hand, will run cooler and draw less power from the mains, which will help to reduce your electricity bill. The ATX spec cites that at full load a PSU should be at least 70 per cent efficient. As an example, a given 600W is very efficient, with an average efficiency of 88 per cent at full load, which means it draws 681W from the mains to produce 600W. However, it's slightly less efficient at 50 per cent, with an efficiency of 87 per cent.



Test sheet for FSP Epsilon 85Plus 600W

TEST 1: 50 per cent load, input 356W, output 300W, efficiency 85 per cent, 94 per cent PFC

Rail	3.3V	5V	12V1	12V2	12V3	12V4	-12V	5VSB
Amps	10A	5A	5A	5A	5A	5A	0.4A	1.5A
Power	33W	25W	60W	60W	60W	60W	4.8W	7.5W
Actual voltage	3.35V	5.01V	11.88V	11.87V	11.94V	11.85V	-11.88V	4.9V

Test 2: 100 per cent load, input 664W, output 600W, efficiency 90 per cent, 96 per cent PFC

Rail	3.3V	5V	12V1	12V2	12V3	12V4	-12V	5VSB
Amps	1A	1A	18A	18A	8A	3.92A	0.8A	1.42A
Power	3.3W	5W	216W	216W	96W	47W	9.6W	7.1W
Actual voltage	3.36V	5.16V	11.42V	11.34V	11.66V	11.61V	-11.62V	4.89V

Test 1: 100 per cent load, input 664W, output 600W, efficiency 90 per cent, 96 per cent PFC

Rail	3.3V	5V	12V1	12V2	12V3	12V4	-12V	5VSB
Amps	1A	1A	8A	3.92A	18A	18A	0.8A	1.42A
Power	3.3W	5W	96W	47W	216W	216W	9.6W	7.1W
Actual voltage	3.36V	5.16V	11.56V	11.6V	11.54V	11.28V	-11.61V	4.89V

Test 1: 100 per cent load, input 680W, output 600W, efficiency 88 per cent, 97 per cent PFC

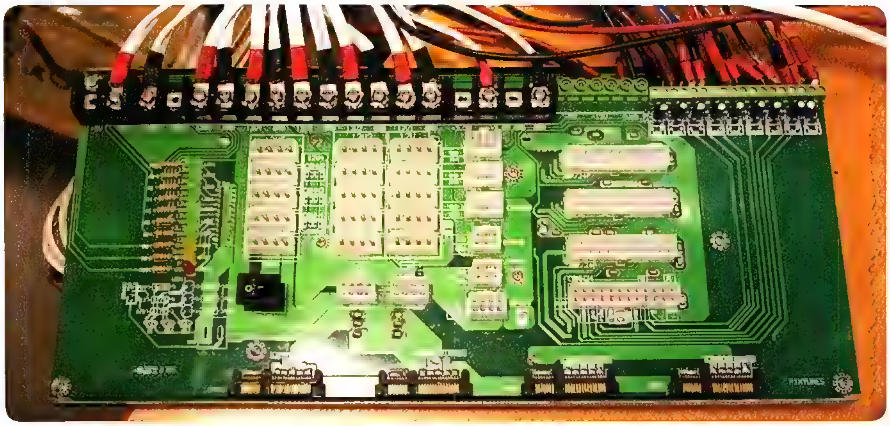
Rail	3.3V	5V	12V1	12V2	12V3	12V4	-12V	5VSB
Amps	10A	5A	10A	10A	10A	11A	0.8A	3A
Power	33W	25W	120W	120W	120W	132W	9.6W	15W
Actual voltage	3.33V	4.88V	11.69V	11.66V	11.81V	11.6V	-11.77V	4.9V

It's also important to test the efficiency of a PSU's Power Factor Correction (PFC) circuitry. The PFC helps to reduce uneven harmonics in the incoming current, which in turn helps to reduce the PSU's power consumption.

The scores

There were several hundred measurements to analyse, but we made the process slightly easier by using the ATX spec as a guide. The voltage stability tests take pride of place in the scoring box and account for 50 per cent of each PSU's overall score. The scores show the number of test measurements that are within the limits of the ATX spec, converted into a percentage to allow PSUs with a different number of rails to be compared. Obviously, we recommend that you only buy a PSU that has perfect (100 per cent) stability.

The Features score includes the overall efficiency and PFC efficiency as measured in the 50 and 100 per cent load tests, plus the number, type and quality of the cables and how noisy the cooling fan(s) are. The Value score is a combination of the Stability and Features scores and the total output (in watts) divided by the price. These three scores added together give the PSU's Overall score.



XFX XXX Edition 650

Buzzes like an insect and has a weak 5V rail.

Street Price $175 **Cables** Modular
Manufacturer www.xfxforce.com

The XXX Edition 650 is the second XFX power supply we've reviewed, although like most of the brands in this Labs test, XFX doesn't actually make the PSU. Instead, the XXX Edition 650 is made by Seasonic – one of the leading PSU OEMs, and a major brand in its own right.

From the outside, you'd be hard-pressed to identify the XXX Edition 650 as a Seasonic, since XFX has designed its own case, complete with muscly metal bulges and a huge green 135mm fan. While the distinctive look of the XXX Edition 650 may not be to everyone's liking, it's good to see that XFX has tried to make its PSU stand out from the crowd of bland, generic-looking models.

Unlike most Seasonic-based PSUs, the XXX Edition 650 has a single 12V rail, rated at a hefty 52A. The other rails are configured as follows; the 3.3V rail at 24A, the 5V at 30A, while the -12V rail outputs up to 0.8A and the 5VSB rail 3A. These rails combine to give a claimed maximum combined output of 650W. True to its graphics card origins, XFX has provided the XXX Edition 650 with four PCI-E cables – three 6+2-pin and one 6-pin.

All five of the XXX Edition 650's rails output a stable voltage at 50 per cent load, with the entire PSU proving to be 85 per cent efficient. This is on the low side for a modern PSU, but much more efficient than 650W power supplies were a couple of years ago. However, the XXX Edition 650 produces a very annoying noise – the closest analogy would be an angry insect flying around your head on a hot summer's night.

This noise was muffled to some degree as the fan sped up at full load, but it was still easily audible. More worryingly, the 5V rail failed to output a stable voltage, dropping to 4.74V, even with a comparatively mild load of 10A applied. As such, we can't recommend the XFX 'insect edition' 650. **JG**

Overall
Unique casing, though 5V dips a little low.
83%

SilverStone OP650

Let down by a weak 5VSB rail and captive cables.

Street Price $144 **Cables** Captive
Manufacturer www.silverstonetek.com

With a retail price of just over $140 and rated at 650W, the SilverStone OP650 competes with the rest of this PSU Labs test. It has a single 12V rail as opposed to two or four. This rail is rated at up to 54A, the joint highest for a single 12V rail on test, which bodes well for power efficiency. Unfortunately, it has captive rather than modular cables, which is something of a surprise at this price point.

The OP650 maintained voltages within the ATX specification from all its rails at 50 per cent load. However, during the stress test, the output from the 5VSB rail slipped to 4.72V. With the ATX spec requiring a minimum of 4.75V, this counts as a fail, although it's the only fly in the ointment for this PSU.

The OP650 has a single 8-pin PCI-E connector and a further four 6-pin PCI-E connectors, which means that it can't support more than one ultra high-end graphics card without the use of adaptors. There are six SATA and six Molex connectors, which should be enough for most systems, even one with lots of fans, drives and lights.

The 120mm fan was quiet up to 50 per cent load, and only became noisy at full load. Even so, it was quieter than many of the other PSUs in this Labs test, and it's unlikely that you'll draw 650W from it for long periods of time.

At 50 per cent and under full load, the OP650 was 86 per cent efficient, which is pretty good, although several other PSUs were an amazing 89 per cent and even 90 per cent efficient. The OP650 is the best PSU we've seen from SilverStone for a long time. However, it isn't the slightly weak 5VSB rail that lets it down, but the fact that, at this price, it has captive cables. We'd suggest spending a little more money, and pick up the Antec TruePower New TP-650, which has flawless stability, a quieter fan and modular cables. **AL**

Overall
Very affordable, but it isn't modular.
83%

Thermaltake Evo Blue W0307

Short cables and a noisy fan let down this otherwise good PSU.

Street Price $180 **Cables** Modular
Manufacturer www.thermaltake.com.au

The Thermaltake Evo Blue looks quite striking, with mesh air vents and a 140mm blue LED fan. It has an attractive price tag and modular cables too. However, the first problem we spotted was the very short cabling, which would struggle to reach the motherboard in large cases such as the SilverStone TJ-07. Even in a small case, the short cables will make keeping them tidy tricky.

Although Thermaltake claims to make the Evo Blue, our detective work has revealed that it's based on a design from CWT, one of the largest PSU manufacturers in the world. The Evo Blue is rated at 650W, so it should be ample for a mid-range PC. There's one 12V rail, which is rated at 48A, one of the more potent on test. While other PSUs have multiple 12V rails, which are safer in the event of a failure, a single 12V rail is cheaper to implement and also more power-efficient.

There are two 6+2-pin and one 6-pin PCI-E connectors, so the Evo Blue can power any high-end graphics card, if the cables can reach it. It also supports 20-pin as well as 24-pin motherboards, and has a total of four SATA and six Molex connectors. Unless you're planning to build a large RAID array, this should be plenty.

When hooked up to the Chroma machine, the Evo Blue performed well, passing all the stability tests. It was a respectable 84 per cent efficient at both 50 per cent and 100 per cent load, although this is a fairly poor result compared with many of the other PSUs on test, which managed close to 90 per cent efficiency. Unfortunately, it was also quite loud throughout testing. At 50 per cent load, the fan was much louder than that of the Antec TruePower New TP-650.

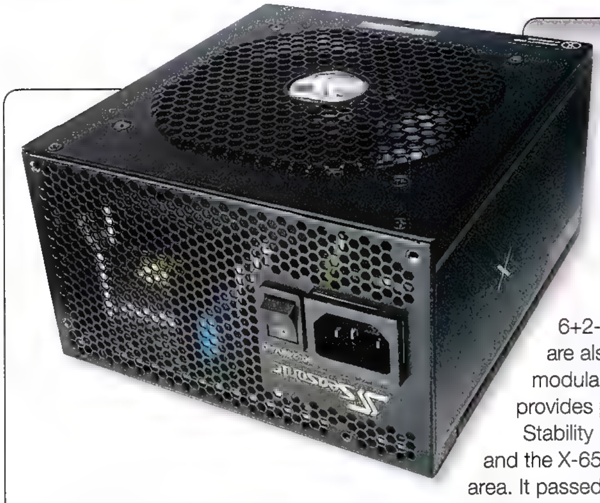
Matters became worse at 100 per cent load, where the fan was downright noisy. The Evo Blue isn't a bad PSU – it passed all our tests after all, which some other PSUs have failed to do. However, the short cables and noisy fan mean that while it's stable, it would be unpleasant to live with. **AL**

Overall
Performs well, but ultimately comes up short.
85%

Seasonic X-650

Awesome efficiency means that it's silent at 50 per cent load.

Street Price $210 **Cables** Modular
Manufacturer www.seasonic.com



Seasonic's own brand of PSUs and the power supplies that it makes for other brands have probably won more awards that any other. In short, Seasonic PSUs are usually a great buy, although they're often quite expensive, as in the case of the M12D-850 ($270). The Seasonic X-650 is no exception; despite being rated at 650W like many other PSUs on test, it retails at a massive $210.

The X-650 has just one 12V rail rated at 54A, which should be enough for an overclocked PC packed full of drives and a couple of high-end graphics cards. The latter is possible thanks to the X-650 having four 6+2-pin PCI-E connectors. There are also eight SATA and eight Molex modular connectors, so the X-650 provides plenty of choice for drives.

Stability is more important, though, and the X-650 had no problems in this area. It passed all the tests thrown at it by the Chroma machine, with all its outputs remaining well within the limits of the ATX spec. What was most impressive, though, was its efficiency. This topped out at 89 per cent at 50 per cent load, and a remarkable 90 per cent at full load.

It was so cool-running as a result of this awesome efficiency that its 120mm fan only needed to start spinning after a few minutes at 100 per cent load. This indicates that it has an awesome trick up its sleeve – in many systems, the X-650 will be silent, as the fan doesn't even spin up under 50 per cent load (300W).

Over the course of a few years, the Seasonic X-650 could pay for itself, thanks to its high power efficiency. Compared with PSUs of just a few years ago, you'd be using up to 70W less for the same power compared with a five-year-old 650W PSU. Even compared with other PSUs in this Labs test, there would be significant gains to be had if you used your PC for more than 15 hours a week or ran Wow 24/7. That said, it would take several years for it to be better value than the Antec TruePower New TP-650. **AL**

Overall
An impressive PSU, though expensive.
92%

Antec TruePower New TP-650

Stable, efficient, quiet, modular and great value – everything a PSU should be

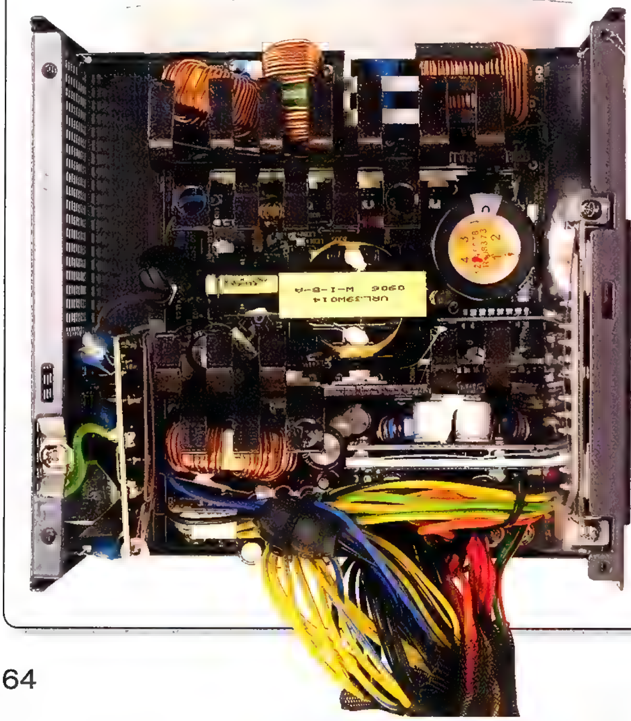
Street Price $157 **Cables** Hybrid Modular
Manufacturer www.antec.com

Antec was arguably the first company to market and sell a branded PSU, as opposed to a generic one. The company has also made some great power supplies over the years, such as one of this model's predecessors, the TruePower Trio TP3-650.

The TruePower series has been given a big overhaul since then. Rather than having captive cables like the older models, the TruePower New TP-650 has partially modular cables. This design helps to reduce cable clutter when building a system, as few PCs will need to use all 26 connectors.

The 20/24-pin ATX connector is hard-wired in, along with the 4-pin ATX12V, 8-pin EPS12V, three Molex, one FDD, three SATA, one 6+2-pin PCI-E and one 6-pin PCI-E connectors. That leaves four colour-coded modular sockets on the front of the case. The black sockets can power up to six more Molex and six more SATA devices, while one of the red sockets is for the one remaining 6+2-pin PCI-E and one 6-pin PCI-E cable. The second red modular socket is unused, since Antec uses the chassis for other models with different cables.

Like many of the other PSUs in this Labs test, the TruePower New TP-650 is manufactured by Seasonic, although it's designed by Antec. It has four 12V rails, the first two being rated at up 22A each, with the latter two each rated up to 25A. They're configured so that 12V1 powers the motherboard and both the captive and modular disk drives. The CPU is powered by 12V2, while 12V3 powers the captive PCI-E and one of the modular PCI-E sockets. The final 12V rail, 12V4, provides power to the remaining modular PCI-E socket. We'd recommend connecting the modular PCI-E cable to 12V4, which is the red socket furthest from the black modular sockets. This will ensure that your graphics card(s) are powered by separate 12V rails.

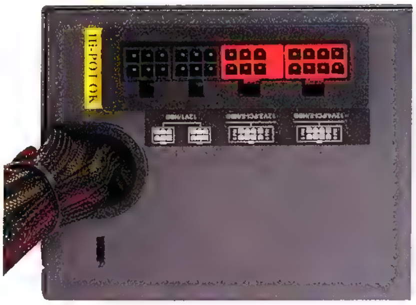


The four 12V rails have a combined output of 54A and are accompanied by 25A-rated 3.3V and 5V rails, plus a 0.8A-rated -12V rail and 3A-rated 5VSB rail. The case is a dull metallic grey and is cooled by a PWM-controlled 120mm fan. At 50 per cent load, the fan spins so slowly that it's essentially silent, although at full load, it begins to make a whooshing noise. However, at least this is simply caused by air movement and isn't an annoying electronic noise.

All of the TruePower New TP-650's rails output a perfectly stable voltage at 50 per cent load, staying well within the limits of the ATX spec. What's more, it only required 376W to produce 326W, so it was a remarkable 87 per cent efficient. Even when we upped the ante to full load, the rails all behaved themselves, with the 12V rails in particular barely straying more than 0.05V from 12V. Although the TruePower New TP-650 is slightly less efficient at full load, averaging 86 per cent, this is still above average for a roughly $150 PSU, and far superior to similar-wattage PSUs of a few years ago.

For any PSU to be in with a chance of a recommendation from us, it must pass 100 per cent of the voltage stability tests we carry out using the Chroma machine. However, while stability is crucial, for a PSU to really catch our eye, it also has to offer something special.

In the case of the TruePower New TP-650, this is its low price of just $157. This wouldn't be a bad price for a captive-cabled PSU, so the TruePower New TP-650 is simply amazing value for money, as it has modular cables. What's more, it sports as many cables as the more expensive PSUs, including four PCI-E connectors. Given its above average power efficiency and super-quiet fan (when running at normal load levels), we have no hesitation in crowning it the new king of mid-range PSUs. **JG**



Overall
The clear PSU to beat in the mid-range market.
94%

Feature Table

	Antec TruePower New TP-650	Seasonic X-650	SilverStone OP650-P	Thermaltake Evo Blue W0307	XFX XXX Edition 650
Features					
Cable type	Modular	Modular	Captive	Modular	Modular
Fans	120mm	120mm	120mm	140mm	135mm
Fan control	Automatic	Automatic	Automatic	Automatic	Automatic
Dimensions (mm) (W x D x H)	150 x 150 x 86	150 x 160 x 86	150 x 150 x 86	150 x 160 x 86	150 x 170 x 86
Claimed output					
3.3V	25A	25A	24A	28A	24A
5V	25A	25A	30A	30A	30A
12V each rail (combined)	22A, 22A, 25A, 25A (max 54A)	54A	54A	48A	52A
-12V	0.8A	1A	0.5A	0.8A	0.8A
5VSB	3A	3A	4A	3A	3A
Maximum combined output	650W	650W	650W	650W	650W
Connections					
Molex	9	8	6	6	6
FDD	1	2	2	1	2
SATA	9	8	6	4	6
PCI-E	2 x 6+2-pin, 2 x 6-pin	4 x 6+2-pin	1 x 8-pin, 4 x 6-pin	2 x 6+2-pin, 1 x 6-pin	3 x 6+2-pin, 1 x 6-pin
20-pin ATX	✓	✓	✓	✓	✓
4-pin ATX12V	✓	✓	✓	✓	✓
24-pin ATX	✓	✓	✓	✓	✓
8-pin EPS12V	1	1	1	1	1
Others	✗	✗	✗	✗	✗

KITLOG

These are our four basic systems, with something for every taste. On this page, the **Basic Game Box** is put together with money-saving in mind, but also an eye to getting as much bang for buck. It's the best value system for those who want a lot of processing grunt, but who don't want to sacrifice the upgradeability or compatibility that is so important. Intel's going to keep the P55 socket around for quite some time, so making the leap to this new platform is well-timed.

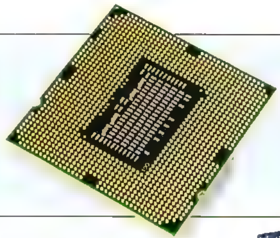
Ah, the hard drive. First invented in 1954, it started with fifty two-foot platters that totalled only 5MB of data. Today, you can grab a drive that packs either three or four platters in a space of only 3.5 inches across, with a total storage space of 1000GB! Sure, you lose a little effective space due to formatting, but they'll keep increasing max capacity.

The Perfect PC, on the other hand, is the system everyone aspires to, with nothing but the best parts – without going crazy, though. It's a collection of all the greatest hardware that we'd pick without a budget, sure to impress with performance and sheer style.

Oh, and if you're wondering what the Ref IDs are, that's the ID of that article on our website. Just enter it like this – **www.atomicmpc.com.au/?NUMBER** – and you'll go straight to that review.

BASIC GAME BOX

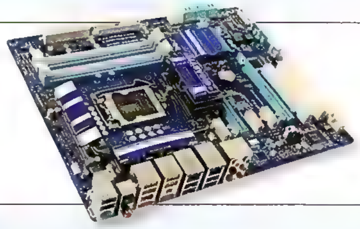
CPU



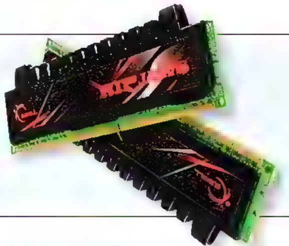
Intel Core i5 750
PRICE $240
Intel's budget quad is more than you'll need in a chip!
Issue 106, Page 36

MOTHERBOARD

GIGABYTE P55-UD4
PRICE $225
A great value P55 board with some nice features..
Issue 106, Page 39



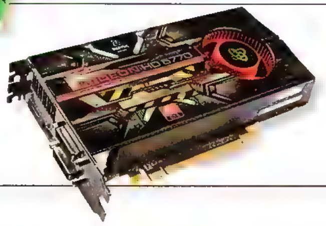
MEMORY



G.Skill Ripjaws 2000MHz
PRICE $190
Great value memory with amazing overclocking.
Issue 106, Page 52

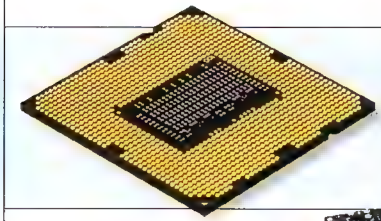
VIDEO CARD

XFX 5770
PRICE $200
A decent value way to get into DX11.
Issue 107, Page 47



THE PERFECT PC

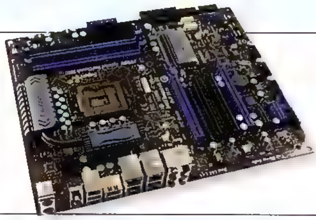
CPU



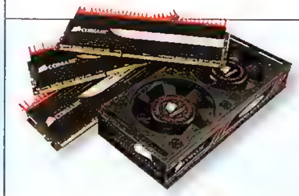
Intel Core i7 870
PRICE $690
The best enthusiast chip, evar.
Issue 105, Page 34

MOTHERBOARD

MSI P55-GD85
PRICE $320
P55, with all the SATA/USB 3.0 extras that we've come to love.
Issue 111, Page 38



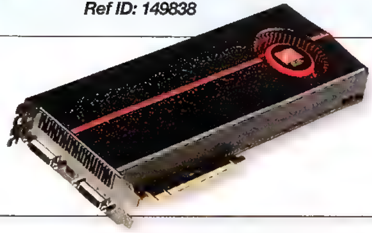
MEMORY



Corsair Dominator TR3X6G1866C7GTF
PRICE $388
Plenty of memory, blisteringly fast and darn sexy.
Ref ID: 149838

VIDEO CARD

ATI 5970
PRICE $940
A dual-cored DX11 beast, the most powerful yet.
Issue 108, Page 34



For more builds check out the Kitlog E-mag at **atomicmpc.com.au/kitlog**

SUBTOTAL: $1699

COOLER

Coolermaster Hyper 212 Plus
PRICE $50

Nice cooling for a very affordable price.

CASE

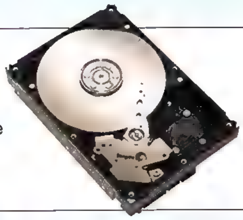
Lancool Dragonlord PC-K62
PRICE $165

Vibration dampened, great cooling and sexy looks.
Issue 105, Page 49

SYSTEM DRIVE

1TB HDD
PRICE $100

A thousand gigabyte storage drive on the cheap.



KEYBOARD

Razer Arctosa
PRICE $50

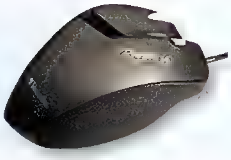
A cool-looking keyboard that'll serve you very well.
Ref ID: 149483

DISPLAY

Viewsonic VX2233WM
PRICE $199

21.5 inches of value-packed screen, great buy.
Issue 108, Page 42

MOUSE



Verbatim Rapier V1
PRICE $65

Great gaming performance and nifty features.
Issue 96, Page 43

AUDIO

Plantronics Gamecom 777
PRICE $85

Solid set of cans with great audio.
Issue 101, Page 41

Onboard Realtek ALC889A
A decent chip that does the job.

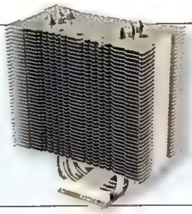
POWER SUPPLY

OCZ ModXStream Pro 600W
PRICE $130

Plenty of wattage, reliable, modular for neatness.
Issue 109, Page 59

SUBTOTAL: $5381

COOLER



Noctua NH-U12P SE2
PRICE $95

Two fans, quiet and nice overclocking capacity.
Issue 107, Page 48

CASE

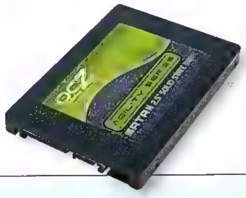
Coolermaster ATCS 840
PRICE $370

Heaps of fans, plenty of space, and dripping with quality.
Ref ID: 132479

SYSTEM DRIVE

OCZ Agility 120GB
PRICE $525

Lightning-fast Indilinx controller speed for your OS and games.
Ref ID: 158083



KEYBOARD

Microsoft Sidewinder X6
PRICE $95

Backlit, sturdy, magnetic numpad & macro keys; what's not to like?
Ref ID: 129535

DISPLAY

Dell 2408WFP
PRICE $899

A huge 24in LCD screen for your prettiest pixels.
Issue 103, Page 57

MOUSE

Microsoft Sidewinder X8 Wireless
PRICE $105

Cable-less, comfortable, lag-free and fraggable!
Ref ID: 148422

AUDIO

Logitech Z-5500D
PRICE $425

Earth-shakingly good.
Issue 48, Page 56

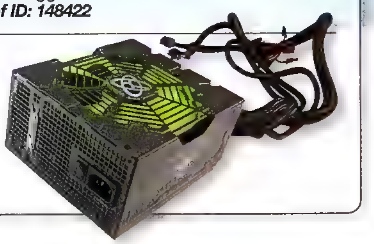
Auzentech X-Fi Prelude
PRICE $279

Best soundcard evar!
Ref ID: 112419

POWER SUPPLY

XFX 850W
PRICE $250

Plenty of power, ultra-stable rails and a great price.
Issue 107, Page 50



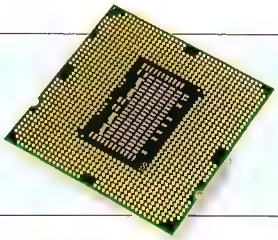
The **LAN Box**, the ultimate in portable gaming power – go anywhere, frag anyone. No longer will you be tied to a desk or forced to awkwardly manhandle your full-sized rig, helped by a convenient handle and beefy tech. Perfect for wowing people at LANs, the tech inside is fast enough to run any game, and boasts enough speed to keep your game running at full clip even if other programs intrude in the background. After all, no-one wants to miss a headshot.

You may notice that we haven't told you what OS to use in any of these builds. Well, that's because we like giving you maximum choice; but if you're wondering what to use, then Windows 7 Home Premium can't be beat. Grab the x64 version so all your memory can be used, and if you buy it at the same time as some hardware, you can grab an OEM copy of W7 for 140-odd bucks. Delicious savings!

Finally, for the more entertainment-minded – and really, that's all of us – there's our **Home Theatre PC**, ready to play movies and music quietly and efficiently. It's got plenty of speed for video encoding while you're away, but makes very little noise thanks to the passive components used – even the heatsink can be dialed down to emit as much or as little noise as you want. Perfect for leaving next to the big-screen TV for all your media needs.

THE LAN BOX

CPU



Intel Core i5 750

PRICE $240

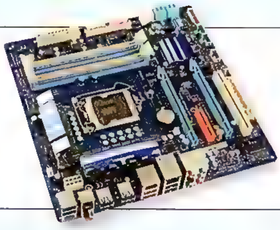
Intel's budget quad is more than you'll need in a chip!
Issue 106, Page 36

MOTHERBOARD

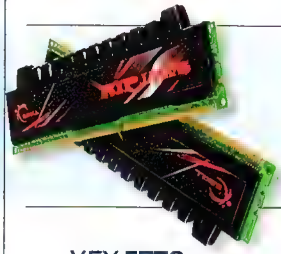
GIGABYTE P55M-UD4

PRICE $195

Great overclockability, nice value.
Issue 107, Page 40



MEMORY



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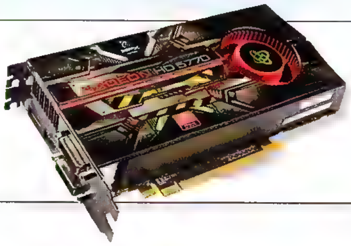
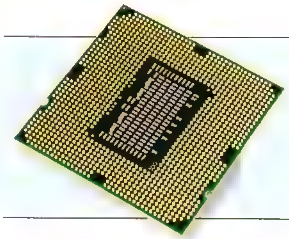


THE HTPC

CPU



Intel Core i5 750

PRICE $240

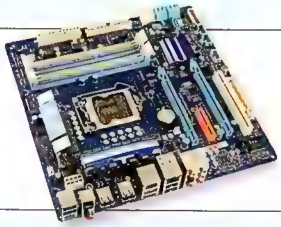
Plenty of power for HTPC duties, video encoding champ.
Issue 106, Page 36

MOTHERBOARD

GIGABYTE P55M-UD4

PRICE $195

mATX form factor doesn't skimp on storage, or speed.
Issue 107, Page 40



MEMORY

G.Skill Ripjaws 2000MHz

PRICE $170

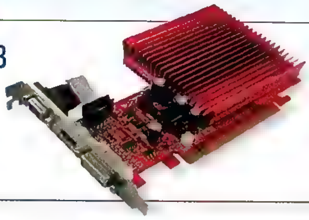
4GB of fast memory is plenty for running multiple HTPC media streaming apps.
Issue 106, Page 52

VIDEO CARD

Gainward G210 512MB

PRICE $55

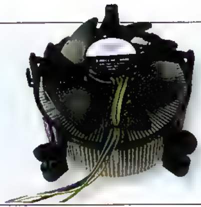
Perfect for Blu-Ray playback.



For more builds check out the Kitlog E-mag at **atomicmpc.com.au/kitlog**

SUBTOTAL: $1654

COOLER



Intel Stock Cooler

PRICE FREE

Does the job, fits under PSU well.

CASE

Silverstone SG04

PRICE $190

Small case with handle; add two 120mm fans for awesome cooling.

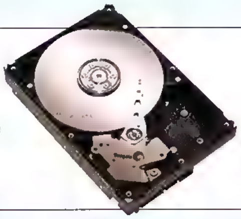
Ref ID: 148266

SYSTEMDRIVE

1TB HDD

PRICE $100

A thousand gigabyte storage drive on the cheap.



KEYBOARD

Razer Arctosa

PRICE $50

A cool-looking keyboard that'll serve you very well.

Ref ID: 149483

DISPLAY

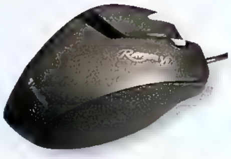
Viewsonic VX2233WM

PRICE $199

21.5 inches of value-packed screen, great buy.

Issue 108, Page 42

MOUSE



Verbatim Rapier V1

PRICE $65

Great gaming performance and nifty features.

Issue 96, Page 43

AUDIO

Plantronics Gamecom 777

PRICE $85

Solid set of cans with great audio.

Issue 101, Page 41

Onboard Realtek ALC889A

A decent chip that does the job.

POWER SUPPLY

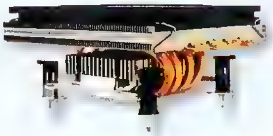
Corsair HX-520

PRICE $140

Modular, efficient and keeps size manageable in cramped case.

SUBTOTAL: $2337

COOLER

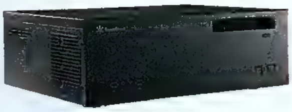


Scythe Big Shuriken

PRICE $79

Tiny 58mm height, quieter than a sponge.

CASE



SilverStone Grandia GD04

PRICE $145

Stylish exterior, 3x120mm filtered fans, 2x3.5" HDD space with plenty of room.

Issue 108, Page 47

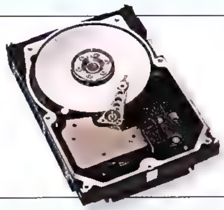
SYSTEMDRIVE

Seagate Barracuda 1.5T

PRICE $145

Fast, voluminous storage for all your pr0n, videos and music.

Ref ID: 141622



KEYBOARD

Logitech diNovo Edge

PRICE $199

Wireless board with a trackpad for mousing.

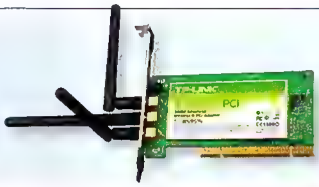
OPTICAL

LG GGC-H20L

PRICE $175

Bluray and HDDVD playback – best of both worlds

WIRELESS



TP-Link TL-WN951N

PRICE $55

Zippy 802.11N for wireless HD video streaming.

AUDIO

Razer Mako 2.1 Speakers

PRICE $469

Stylish tub-thumpers.

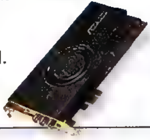
Ref ID: 126695

ASUS Xonar HDAV 1.3

PRICE $270

Nice sound, expansion good.

Ref ID: 135112



POWER SUPPLY

Corsair HX-520

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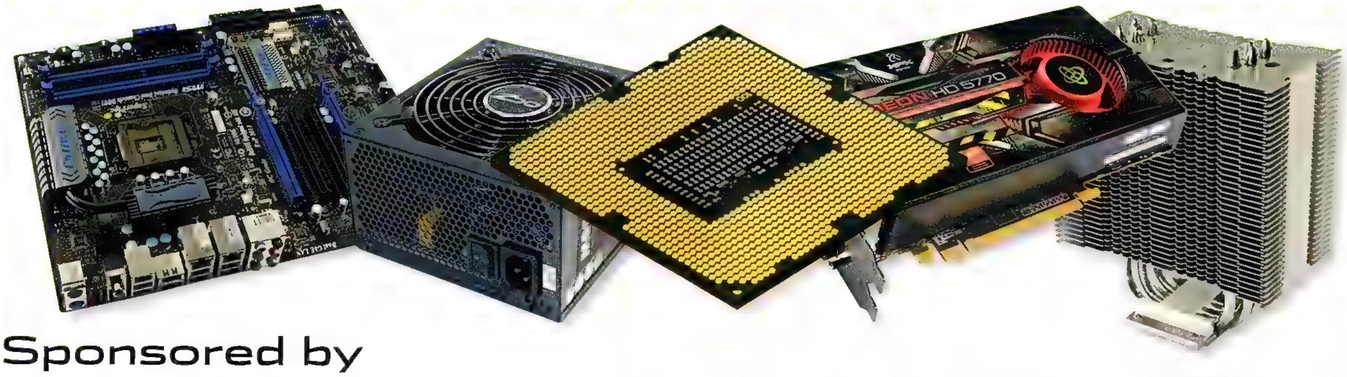

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Next stop: Hardware piracy

Daniel Rutter prints his own plastic.

I last wrote about rapid prototyping almost five years ago. There've been some changes.

Rapid prototyping is what it sounds like – making things (technically, by sticking some cohesive material together, not by carving away parts of a block) faster than you could do it by hand, usually for the purpose of developing prototypes for something that you intend to manufacture in a normal factory.

There's a rapidly expanding enthusiast community, though, who are more interested in making small runs of final products, right there on the desktop. People have started calling this 'fabbing', and there are now several 'fabber' projects for home users. (The biggest names so far are 'RepRap', 'Fab@Home' and 'MakerBot'.)

If you don't have a major-industry budget, you do still *have* to build your fabber at home. And a machine that can print you an iPod is still about as far away as fusion power. But compared with the rate of progress in most industries, fabbers are developing at a lightning-fast pace. If it looks slow, it's just because we're all spoiled by the frankly outrageous rate of improvement of computer hardware.

> If it looks slow, it's just because we're all spoiled by the frankly outrageous rate of improvement of computer hardware.

The sci-fi-story dream fabber takes a blueprint for a mobile phone, crossbow, turbocharger or original G1 Walther P-38 Megatron, chugs away for a few hours, and then delivers the toasty-warm, just-like-a-bought-one item into your hands.

Don't hold your breath for that to happen. You'd need cyberpunk nanotech to make it feasible, plus either a ridiculous amount of different feedstock materials, or a tame alchemist.

In the real world, though, I wouldn't be surprised to see home fabbers printing arbitrary custom Lego components some time in the next five years.

This would be more significant than you might think at first. Current fabbers can make things that're just barely compatible with Lego, but they don't yet have the precision to do it properly. Once you can make commercial-quality Lego, though, you can also make a long list of other quite serious engineering components. Home fabs are getting there.

Desktop fabbers do already cost less than $1000, though. The bulk plastic most of them extrude isn't expensive, either. They're definitely more accessible to the home hacker – or, at least, easier for the home hacker to lift – than many standard machine tools.

The specialised Web sites are showing up now, too. MakerBot Industries' 'Thingiverse' is your one-stop shop for free design swapping and collaboration, and 'BatchPCB' is essentially Zazzle for circuit boards. 3D *scanners* are slowly getting better and cheaper, too. By the time it's unremarkable for hobbyists to have a 3D printer in the garage, they'll also be able to easily scan that broken piece of plastic that's stopping your gadget from working, and then fab an unbroken version, from a tougher polymer.

Inventors have to invest a lot of effort in keeping up with the state of the art in their field, and in making the tools, to make the tools, to eventually make something new. Internet collaboration has made the first task a lot easier, and fabbers are making inroads on the second one.

I don't really know where home fabbing's going, though. I suspect that while we're all distracted by people making Nerf guns and Stormtrooper armour, someone's going to startle us all with something like a $20 home-built DNA computer.

People are starting to make their own printers, too. This seems a bit silly, until you realise that 'printing' can involve a lot more than just ink on paper. E-paper, solar cells, skin grafts...

Or maybe someone'll come up with a price breakthrough in 3D *micro* fabrication. Commercial focused-laser microfabs can make mechanical parts below micron scale (for comparison, the micromirrors in a DLP projector are more than ten microns across). Soon, hobbyists could be making autonomous robots the size of sugar cubes.

One thing's for sure, though:

If you sell collectible action figures for a living, you should be nervous.

Dan is never nervous about new tech.
dan@atomicmpc.com.au

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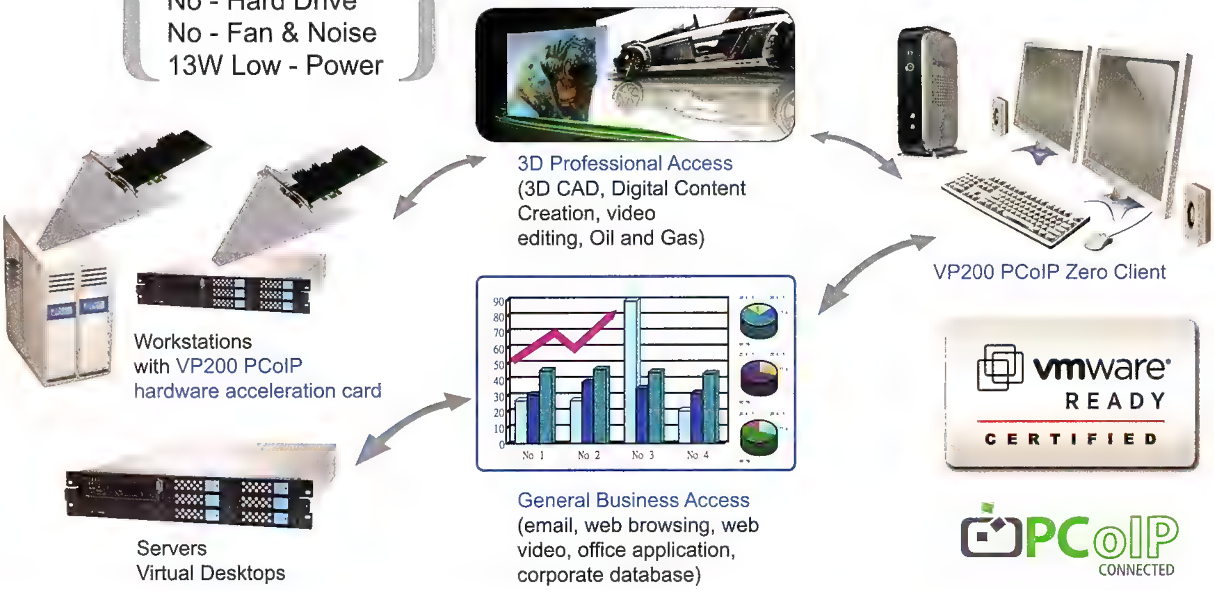

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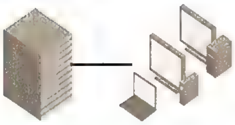
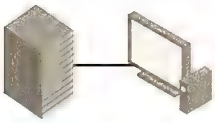
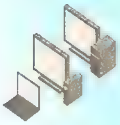
	Thin Client	VP200 Zero Client	PC
			
OS Restricted	Yes	No	Yes
Drivers	Yes	No	Yes
CPU	Low Power CPU	No CPU	Yes
Control Response	Slow	Fast	Fast
Graphics Performance	Poor	Great	Great
Applications	Limited	Great	Great
USB Device Support	Limited	Great	Great
User Experience	Frustrated	Like PC	Like PC
Security	Store some data on the desktop client	No data on the client	Store data on the PC
Viruses and Spyware	Yes	No	Yes
Client IT Management	Heavy	No	Heavy
Green Requirement	High power consumption / High Noise	Ultra-Low power consumption / Noiseless	High power consumption / High Noise
Ideal user type	Task	Task, Knowledge	Task, Knowledge

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TUTORIAL

HANDS-ON TUTORIALS FOR THE TECHNICALLY MINDED

We're returning to the tutorial section this month, kick-started by the ever-knowing and all-seeing Chris Taylor. He's kicking Atomic.edu into submission, bringing you firsthand info on how to make the big bucks in the big world of web design; it's a definite must-read!

Stacked on top of the already information-packed tute section, we're throwing a follow-up article on photography your way.

The dark art of long-exposure pictures is one that pro photographers have been taking advantage of for years, but their secrets and skills have been 'borrowed' to grant you the ability to take some incredible photos. And +2 charm. If you've given our last guide a go, this is a great bunch of fun!

An exciting third issue of our KitLog e-mag has launched, too, bringing you an exclusive online-only watercooling guide that has never graced the pages of the mag; if wetter is better, this is the best damn guide in the history of KitLog. So read on, and open up your brain-sponges for learning!

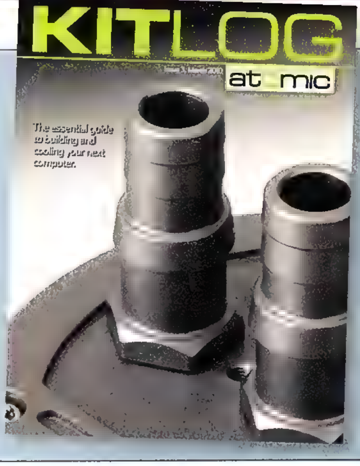
TUTORIAL CONTENTS

Atomic.edu 76

Chris Taylor shines some light on web development: how to get noticed, and make your mark.

Advanced Photography Techniques 78

A follow-up long-exposure tute on generating exciting photo effects.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Web design

Chris Taylor leads you on a quest for getting your code out there.

It's a safe bet that if you're reading this, you have some familiarity with HTML. I'm practically dyslexic when it comes to programming languages, but I managed to grasp the rudiments of what is the most ubiquitous of mark-up languages quickly and easily. It was a valuable skill in the late 1990s and early 2000s. Many businesses were in desperate need of Internet literate outsiders; they had simple placeholder sites or no online presence at all. There existed an opportunity for a lot of web designers to make a lot of money.

Times have changed. Many businesses have online presences. Websites tend to be more than placeholders. Increasingly, web sites are moving away from being advertisements for a physical store to being the store. Businesses, of course, need people to maintain and redesign these websites, but is the market too crowded? Is it still possible to make a good living off web design as a sole trader? What skills are required to survive in a market when the needs of most of your potential clientele are, to some extent, already met?

This month we spoke to two guys who earn a crust through web design: sole-trader Jono (**www.thexman.net.nz/web-design/index.php**) and Pacnet (**www.pacnet.com**) employee Lalor McMahon.

Q: Is it still possible to earn a decent living designing websites?

"Most definitely, whether it's for a design house, a larger company or yourself, there is always an opportunity to make a living from web design," says McMahon. "However, web design is only part of the mix: you need an understanding [of] what a website can actually do for a business. Websites these days are no longer an online brochure talking about the business. Today's culture expects more and thus you have to deliver via interactivity, engagement and content. The design aspect really is only scratching the surface by making the site appealing and thus keeping visitors on the site."

"Possible, yes. Easy, no. Not any more," says Jono. A large part of the challenge seems to be in setting yourself apart from the competition. "Web design has diversified hugely in the last ten years, both in terms of how it's achieved and what people now expect from it. In a world where the 'experts' (genuine or otherwise) claim they can do everything, you need to focus more on your actual 'human' service than an electronic product. I find in particular responding to any query as fast as humanly possible and keeping the client in the loop all the way along works wonders in setting yourself apart from any potential rivals."

Q: What skills do you need, aside from the obvious (HTML, CSS, Flash, etc) to be a successful web designer?

"A solid grounding in XHTML, CSS and W3C standards is an absolute must," says McMahon. "PHP and jQuery is where I do most of my work in the backend. However, these days you need to justify your work and show it is actually helping the business' bottom line. This is where search engine marketing and authoritative content comes into it, utilising search engine optimisation and pay-per-click along with a good analytics package, you can report on the key things important to the online business: traffic, leads and conversions. Content is king; if you don't have good, [relevant] content, you won't get traffic to the site and will ultimately see a decline in site traffic. A good logical brain also helps in making the site usable; user experience will either make or break the site, so careful attention needs to be put into the layout and steps required to access information."

"Once again, 'human' skills," says Jono. "The ability to talk to people, a genuine flair for design, an eye for proportion and colour, effective time management, research. Oh, and the guts to admit it when you don't know something."

Q: For someone who is starting to design websites in their spare time and hopes to get paid for their efforts, what's the best place to start?

"If you want to get into the world of web design, one of the best places to start is 99designs.com," says McMahon. "It's a job board for designers covering everything from print to web and is a good way to get your foot in the door and build a folio of [completed] work. And you get paid if you are successful. Other than that, offer your services to whoever you think needs it. Businesses still don't understand what a website can do for them so if you can convince them to take you on, the ball just keeps rolling as there is always something new in the online scene."

"Put together a portfolio," says Jono, "even if it's a bunch of freebies for friends and family. As long as your work looks and performs professionally, it'll be a potentially effective beginning. From there, hunt down local businesses with bad websites or none at all [and] put together a couple of design proposals for each, along with a spiel about how much better things would be if they had a decent web presence."

Q: Should you target a specific market?
Says Jono, "To begin with, yes. Pick a niche you know you're good in and run with it for a while. Then, when both your skills and new clients begin to expand beyond that, so should you, but only if you're comfortable that you're not sacrificing the areas you're successful in to do so."

Q: How can you advertise your service?
"[The best form of advertisement] is word of mouth," says Jono. "It's free and by far and the most effective [method]. If a client is delighted with what you've done for them, encourage them to tell others. Apart from somewhere to show off your portfolio, a website of your own is probably only really important if you're gunning for lots of time-wasting inquiries. And that's assuming you blog on it enough to keep it up in the top 500-odd search engine results. Advertising in your local newspaper can occasionally yield results, but be careful the costs don't exceed the extra business it may bring in."

Q: Do qualifications – TAFE certificates and the like – help?
"To a degree some qualifications do help," says McMahon, 'but you really only start learning when you actually sink your teeth in and do the work. I find a lot of courses are behind the times in regards to the standards and the current practices in coding HTML and CSS or they teach you to design in FrontPage! There are much better resources available on the web where you can learn everything from simple HTML and CSS to scripting as well as the more advanced engagement techniques like Augmented Reality (**en.wikipedia.org/wiki/Augmented_reality**). TAFE courses will only get you so far. Get on the web and teach yourself. If you can demonstrate your ability you are more likely to get that job rather than relying on a piece of paper."

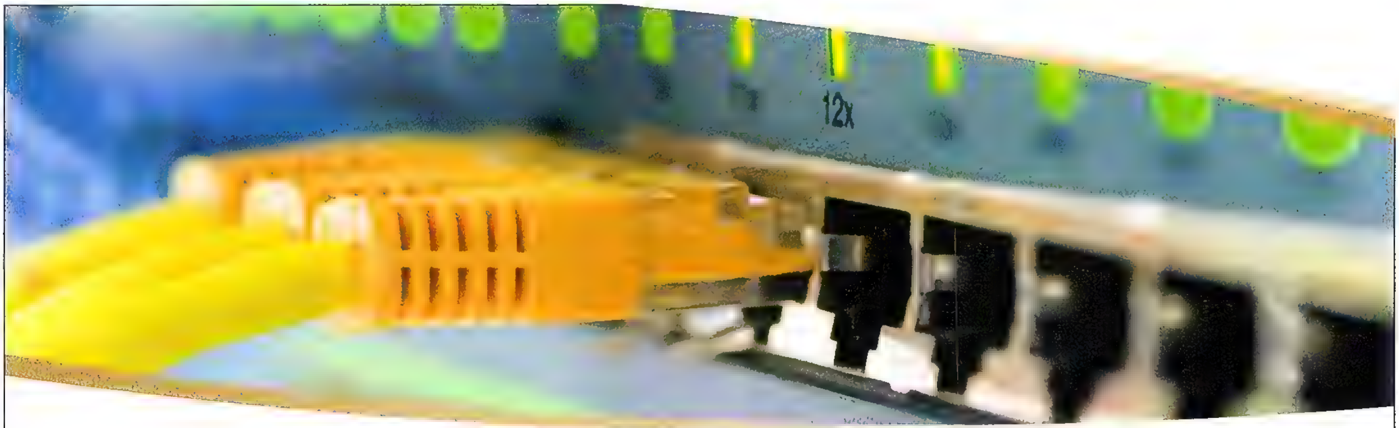
"I find a lot of courses are behind the times in regards to standards and practices..."

"Not especially," says Jono. "Usually the only people who get hung up on qualifications are campuses, universities and the people selling them and prospective employers. The education you receive in the process, however, can sometimes be quite beneficial."

Where to begin
TAFEs, as well as private institutes like QANTM (**www.qantm.com.au**), offer a variety of potentially useful courses ranging from intros to Flash to full-blown Bachelor degrees in Creative Media. Universities offer degrees at the Bachelor level and above in multimedia. If you're looking for money to pay bills and buy beer while you're studying, a Diploma or Bachelor is excessive. In that situation, a short course or Certificate-level qualification is only worthwhile if you are seeking an introduction to an unfamiliar technique or software suite. Good books are available and, as McMahon said, plenty of websites exist that can help you develop your skills. The W3C site (**www.w3.org**) is and always has been a quality resource for learning the syntax of HTML, CSS and XML, as well as for familiarising yourself with the most recent agreed-upon standards.

In addition to technical skills, it is vital that as a sole trader you have some awareness of your legal status. The government expects you to register for an Australian Business Number. It's a free and painless process that can be completed in the comfort of your own home via the Australian Business Register (**www.abr.gov.au**). An accountant can take care of it for you, but expect to be hit with a bill of seventy bucks or more for the privilege.

Your obligations with regards to tax depend on how much money you earn. Rather than getting yourself into hot water through ignorance, it's worth contacting the ATO and requesting free publications relevant to your situation. Alternatively, ask an accountant if they can explain the lay of the land for you.



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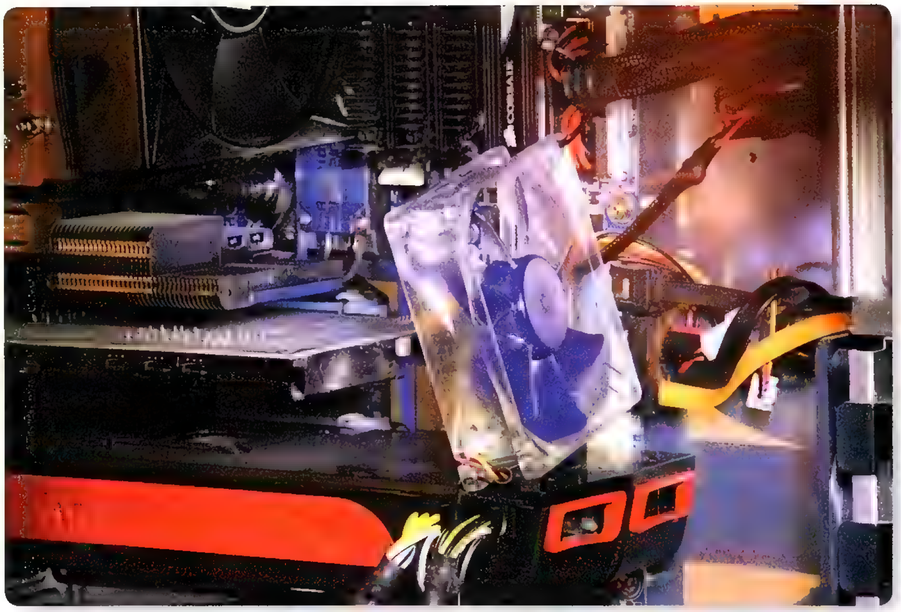
Advanced Photography *Techniques*

Justin Robinson gives your tech more sex appeal.

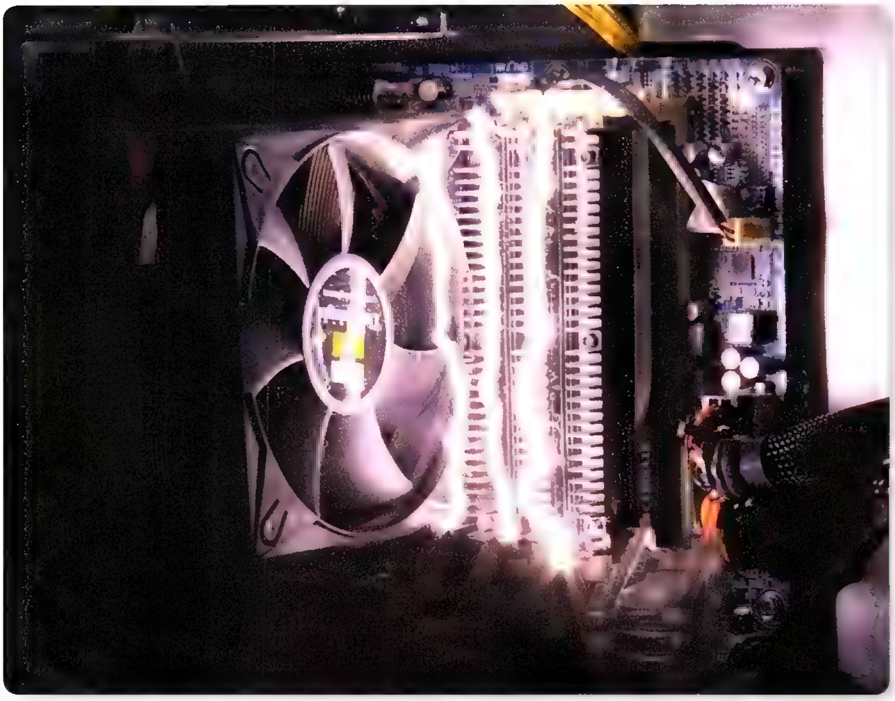
You've got your brand-new build all completed, benchmarked, and cabled to bursting. You've also got your dusty old DSLR camera that has seen a month of disuse after our last photography tute (Issue 111, Page 75) that showed you how to take some professional shots of your rig with nothing but a lightbulb and a pocketful of dreams. We're going to bump it up a notch this month, and introduce you to a long-favoured technique: long-exposure photography. The gear you need is a computer (or other interesting piece of hardware), a simple bright white LED torch like you'd hang off your keys, a sturdy tripod, and a DSLR camera with aperture priority control (though full manual is preferred). Ready? Good!



What is long-exposure photography?

Long-exposure photography is pretty much as the name suggests; letting the image soak into the camera's sensor for a longer period of time. The principal is practically the same as when a hobo strips off and prances in front of your eyeballs; the longer you look, the longer his willy will be burnt into your memory. To prepare your computer for this kind of shot, darken the room that you'll be working in as much as possible, and make sure you set up the tripod on a stable surface. Stable doesn't have to mean perfect – ours was balanced on a bed with three books – it just has to be immobile.

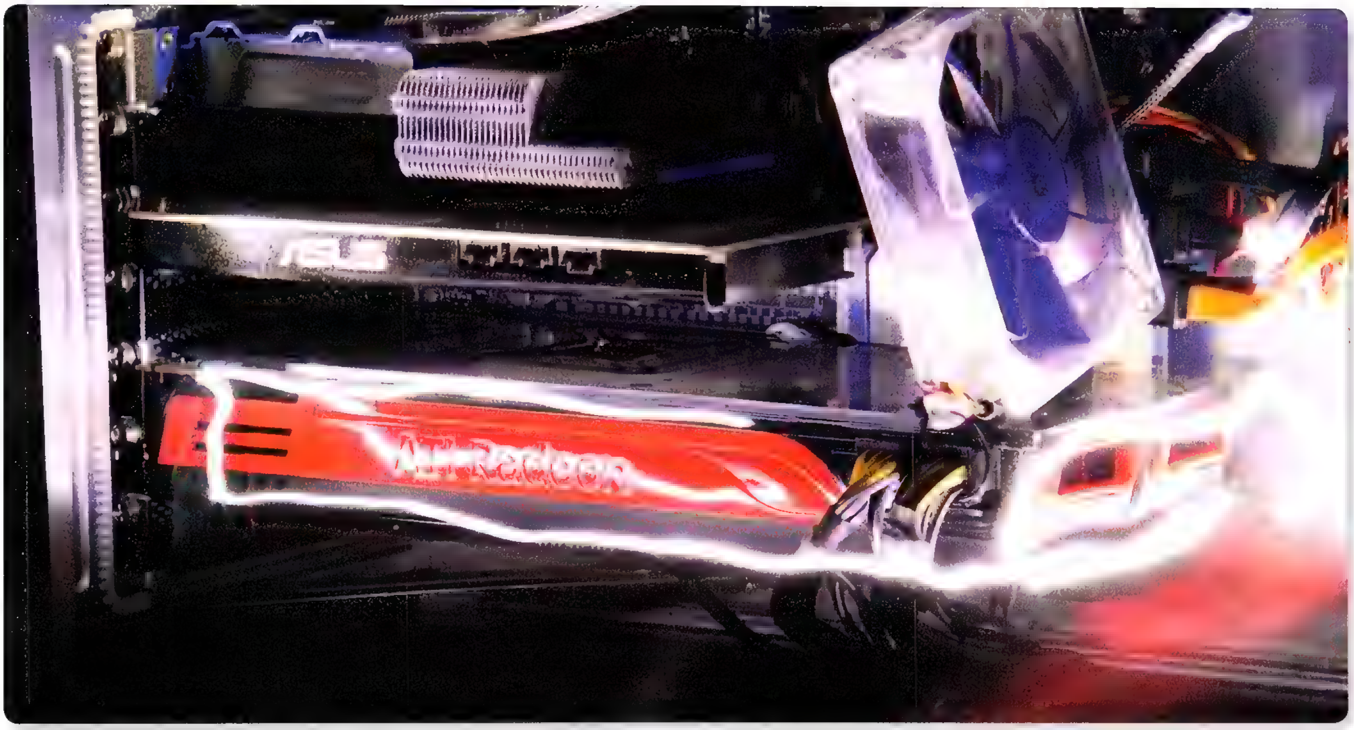
Flick your camera over to manual mode (or aperture priority, if you don't have that option) and boost your exposure to something quite high. We started at F/22, which gave us an effective exposure time of eight seconds – the total amount of time we have to work our magic within. Dialling in a ten-second self-timer, the lowest ISO setting available and manually bringing the inside of the case into focus, we got to work with the LED torch.



Special FX

If you've set everything up correctly so far, hitting the shutter button will give you an image in roughly ten seconds that is pretty darn black. To spice things up a little, the most basic effect you can create with the torch is a 'spotlight' effect: hit the shutter on the camera, and point the torch at one component in the system. The end result will give you a centre-of-attention shot that highlights a single component with minimal light bouncing around to the surrounding components; it's a nice way to show circular heatsinks, or fans.

However for something a little more exciting, you'll want to get immersed in the concept of light trails. These are created when a bright source of light is detected by the sensor,

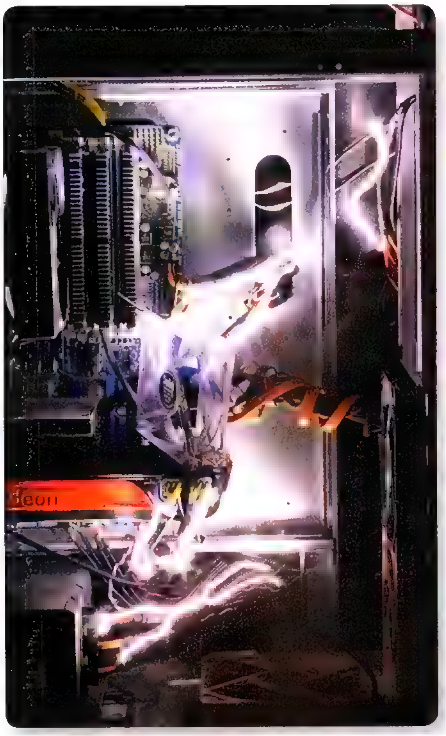


resulting in a visible line of light that appears to hover around the components in 3D space. To do this, simply hit the shutter, and reach into the case with the LED torch, moving it slowly around the edges of the piece of tech you're showing off – which gave our 5870 a powerful-looking glow, and minimal highlighting on the other components. It's a great way of separating out high-performance bits of tech in an interesting way!

> It's a great way of separating out high-performance bits of tech in an interesting way.

Straight outlines aren't the only effect you can create with these trails; you can also use them to give tech a bit of emphasis. Have a particularly cool-looking fan? Give it swirling trails that flow from its blades! Give your hard disk some attitude – otherwise known as longitudinal recording – pepper its surface with horizontal lines of photonic data! We've turned our otherwise standard Corsair triple kit into electricity-spouting tesla spikes, and the only limitation here is the limits of your dexterity.

If you're feeling particularly adventurous, throw your ISO to higher levels to give you better exposure lengths and attempt a whole-system wrap of light trails, outlining the coolest components or power cables. The end result will be totally unique, a lot of fun, and is sure to pique the interest of others in a sea of standard case build shots.



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KITLOG

Issue 3, March 2010

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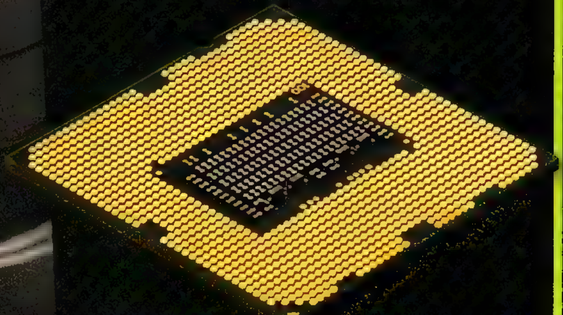

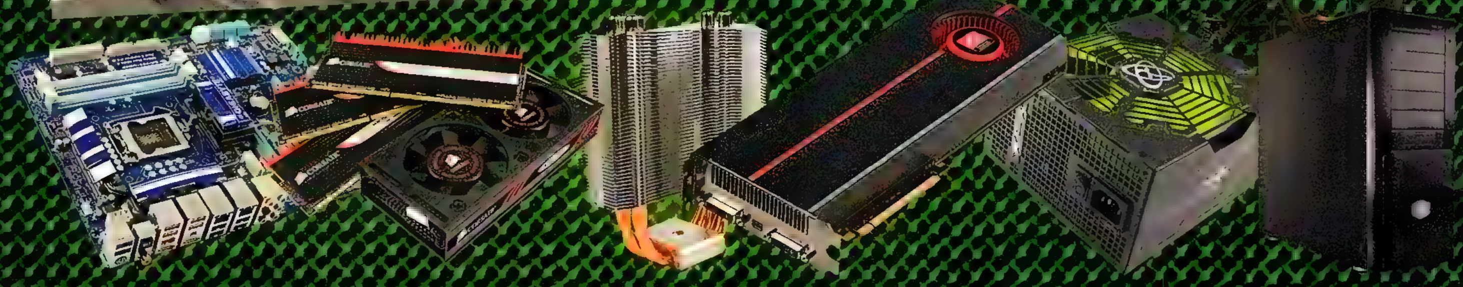

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GAMEPLAY

GAMES, GAMING AND FILM COVERED... ATOMIC-STYLE

Gaming is what every ultra-powered uber-box boils down to in the end, and none stressed gamer rigs as much as Crysis did when first released. The sequel is bearing down upon us with looming force, but can it pull off the visual success and popularity of the original? We find out in a gigantic Engine Room!

On top of Crysis 2 we've also got our stellar Mod Matters, led by modding guru Ashton Mills. If ever there was a man with a desire to change everything about anything, Ashton beats him half to death with sheer enthusiasm!

Also being served up this month is a dose of baddie-shooting Bad Company 2, the sub-hunting Silent Hunter V, a disappointing C&C4 and an expansion for DoW2. While this Issue doesn't match last Issue for volume, there is more gaming quality here than any stick could poke.

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PC gaming's most exciting sequel!

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Crysis 2

The hardware crusher returns, and this time it's scalable.

How does your PC stand up to Crysis? Hopefully by now it's doing alright, but when it first hit our hardware back in 2007 this was a fascinating question. Three years later, Crysis 2 is closing in on your hardware once again, with an updated engine to give our latest CPUs and graphics cards something other than prime number searches to get their exercise.

This ain't no tech demo

For those who love to crunch the numbers, it's easy to let the engine overshadow the game itself. And Crysis 2 is no simple sequel. Crytek is taking Nomad out of the Pacific jungle of the original and dropping our hero into the thick of the toughest 'jungle' of all, New York City (oh yes, the marketing synergies of such a metaphor will be unstoppable). Especially tough when the rat race has been replaced by an urban war zone.

But then again, New York is well trodden turf in games and at the cinema. What's Crytek's special angle?

"I think we are depicting New York in our own 'Crysis Urban Jungle' style, with a clear visual signature," says Nathan Camarillo, Executive Producer on Crysis 2. "The portrayals of New York in movies like 'I Am Legend' and 'The Day After Tomorrow' were both very unique to them, so they each now 'own' a version of the city. With Crysis 2, we've set out to do much the same thing."

"You'll see all our concepts working in harmony: together with the Nanosuit you'll wear and the unique enemies you'll fight; you can also expect some shocking surprises in our take on New York City," says Camarillo. "Crysis 1 was set on a realistic island, but we changed that setting in ways the player did not expect through dramatic moments and alterations to the jungle environment. You can certainly expect transformations of larger magnitude in Crysis 2, giving you a New York City experience like no other in either games or cinema."

The new setting also brings with it a lot more opportunities in gameplay than we experienced in the original Crysis. One big factor Camarillo was eager to talk about is the addition of vertical gameplay. Given the power of the Nanosuit, you'll be jumping between the floors of buildings, jumping onto buses, trucks, down into craters, as well as from one building to another.

"The player is much more mobile in a real city

Look out! Aliens!

For those disappointed by the aliens in Crysis 1, Crytek wants you to know they feel your pain.

"The aliens were visually fun and quite interesting to fight in some cases, but overall they weren't very challenging and they kind of broke the convention of gameplay you'd been learning over the course of the game," says Camarillo. "So in Crysis 2 we changed our aliens. They're still related, fictionally, but we've changed our aliens to be bipedal. They're much larger than humans and are pretty intimidating. They use the human AI as the basis for their technology, but they're more mobile, more agile, they get around in the urban environment in a much more dynamic way than humans can. Humans are pretty ground constrained, though they can clamber up on things, but our aliens jump up on things, jump off of things, so it really gives you a better feeling of being in a 3D environment and having 3D combat without having things flying around you. We're really turning up the focus on alien combat."

playground and can change his position more often."

Some elements of the new CryENGINE3 will also look even better given the new setting.

"One great example for sure is our new rendering technique, Deferred Lighting," says Camarillo. "It allows for a huge number of dynamic lights in a scene, without requiring a high amount of processing power. And this is of course pretty much ideal for the New York setting."

The era of 'constrained freedom'

In recent interviews Crytek has used the term 'constrained freedom' to describe the way players can move through Manhattan. Given other games have very much treated a space as large as Manhattan as a kind of sandbox or open world concept, it seems Crytek has its own angle on balancing openness with a tighter game experience.

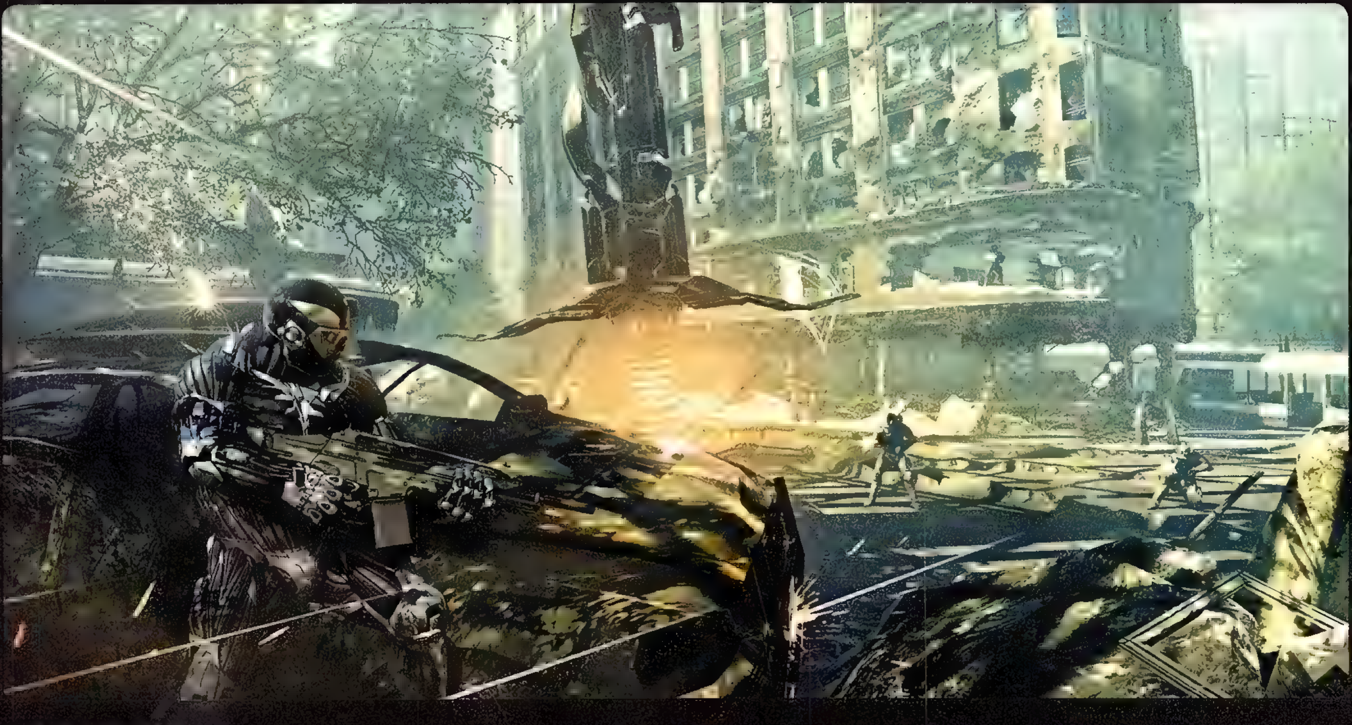
"Same as Crysis 1, Crysis 2 is a sandbox game," says Camarillo. "But in contrast to the commonly held opinion, for us, sandbox means something different."

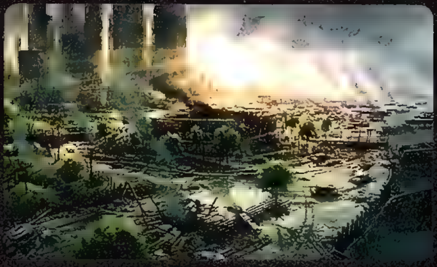
"A Crysis sandbox has borders and a visible world that extends beyond those borders but, more importantly, we go into more detail within that space. In other games, for instance, your interaction may be limited to weapon choice but we let you customise everything down to your weapon attachments."

"We also give you multiple approaches within the game space so you can see clear opportunities for using different tactics against your enemies. There are many objects you can interact with and use directly. In the end, it's still about choice, but those choices range from high-level decisions down to very granular choices and interactions."

Camarillo also feels focusing the 'sandbox' also makes for a more focused campaign.

"To create a consistent and compelling game world, you must, in my opinion, sprinkle it with bits of story all over the place for the player to discover and piece together themselves," says





Camarillo. "The main plot has to be accessible and easily understood to move the experience logically from scene to scene."

"In Crysis 2 we want to provide more story depth for our fans who want a richer and more involved game world, without making it mandatory for those who want to experience the game without additional details. We definitely plan on using ambient storytelling to support our high-quality cinematics and interactions with the characters of the story."

Brute force, meet scale

"Even two years after the release of Crysis, the sentence, 'Can it run Crysis?' is still in gamers' heads," says Camarillo. "The game set an incredibly high benchmark, especially in terms of graphics. We're convinced that we can do it even better with Crysis 2."

But this is also the time of PCs and consoles living in harmony, so Crytek has focused on making this an engine that, while at its best at the top end of town, still looks the goods where less power is on offer."

"The big challenge that developers experience when developing for both the PC and consoles simultaneously is mainly the different specs that can be summarised by the term 'scalability'," says Camarillo. "Unfortunately the exact system specs of Crysis 2 are not determined yet. But one thing I can definitely assure: Crysis 2 will surprise in many ways."

"The main thing is with minimum spec, as far as baseline hardware goes, if you can make a machine that performs at the level of current consoles you will be able to play it," Camarillo continues. "On PC, obviously there are some easy benefits like having higher resolution textures and stuff like this. With additional shader support, additional shader quality, things like that, PC gamers can expect to receive that a console couldn't do. The visual discrepancy will be in the fine details. Otherwise it's the same general experience and performance everywhere."

> Rather than just adding textures, lighting, more everything, Crytek is using real-time capabilities to make the experience deeper...

And Crytek is making some big promises to other developers, too, with the hope CryENGINE3 can solve many development issues for multi-platform production.

"The decision to enter the console market for engines was first driven by our desire to make console games — that's something we've always wanted to do. CryENGINE3 is offering many advantages especially for console developers. The most important one is the Live Create functionality that is making CryENGINE3 100 per cent Real-time. With no pre-calculation or loading times, there are now no delays to developers seeing their creations in-game. This allows a significant faster overall project progress and thus increases quality and significantly reduces the risk of multiplatform development."

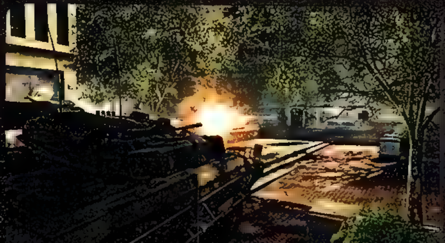
For the brute force lovers, we're also being teased with 'coming soon' news that CryENGINE3 is going to be an engine that will continue to impress, and get better, as new computer hardware comes online in the next couple of years.

"Yeah, definitely. There are some things we haven't announced yet that will definitely take that into account. It's something I can't talk about yet, but we definitely plan for this to be a game people grow with hardware wise."

The colour and the shape

An exciting feature of CryENGINE3 is its delivery on the positive trend to ensure the technology enhances the story. Rather than just adding more textures, more lighting, more, more, more everything, Crytek is using the real-time capabilities of CryENGINE3 to make the experience deeper in some subtle ways. Like real-time colour grading to change the feeling of a game scene on the fly.

"We can use this for not only setting mood, but for also telling the visual story from beginning to end," says Camarillo. "For what



The curious case of Direct X 11

We asked Crytek what the compelling reasons would be for gamers to want to play Crysis 2 under a Direct X 11 setup. Crytek will make no official statement on the subject yet, though it's plain as day that this is going to be supported.

"You can imagine we're always on the cutting edge of everything," says Camarillo. "So there will probably be support for that but we're not talking specific details on that yet.

Yes, that's right. Probably...

It's all part of the modern promotional game, see. Developers like to have big, shiny, exciting things to announce every month or so to keep the game buzzing along before launch. So Direct X 11, while an obvious solution for any 'future' engine, is being held back as some kind of surprise down the track. Sadly, this means Crytek won't talk engine benefits and what, if anything, will make it worth the upgrade.

location you're in, what's going on in the story, who else is present at that point in time. Are you fighting humans, or are you fighting other entities like aliens? We can change the mood and feel of the game environment to foreshadow a big event. It's a really powerful technology and it gives the game overall a unique look that is generally reserved for post-processing in film."

This fits into a tasty new trend for visuals stepping away from super realism and toward artistic enhancement of the gameplay.

"When this generation of console games were in pre-development, before the Xbox 360 and PS3 launched, everyone was talking about what the power of next generation console gaming would give us. And we talked about this kind of stuff back then," says Camarillo. "Even after the consoles launched no one has really done this, to make these kinds of changes in real-time, until now. There are some games that do it by level, say, but not dynamically changing these things in real-time. And it takes us into a deeper finesse on experience and storytelling, and that's a really important thing."

It's really about having fun

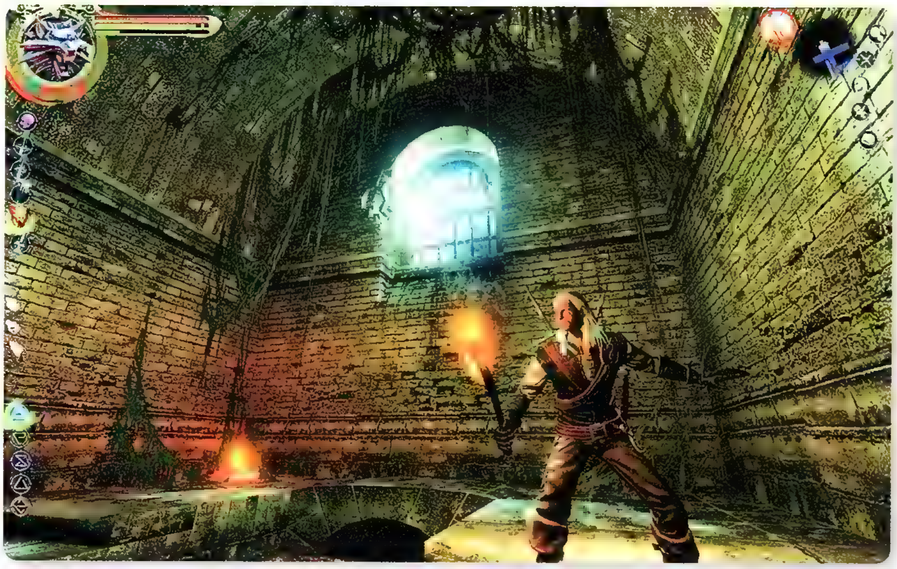
Above all else, Crytek is keen to make sure people see that Crysis 2 is about having more fun in the game. They're having more fun making it, and they want you to have more fun playing it.

"Things like the interactivity and the choices you can make. If you interact with an object and you think 'I wonder what happens if I do such and such.' We're trying to think of those things and put little nuggets in there that people will have fun playing with."

A hardcore game engine maker talking about making the game more fun? Bring it on! **SB**

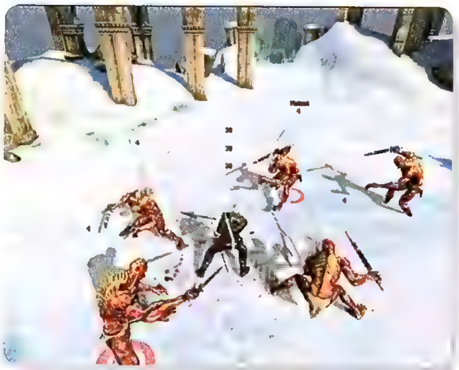
MODIFICATION

with Ashton 'For the love of Mod' Mills



Full Combat Rebalance

Game The Witcher
URL www.moddb.com/mods/full-combat-rebalance1



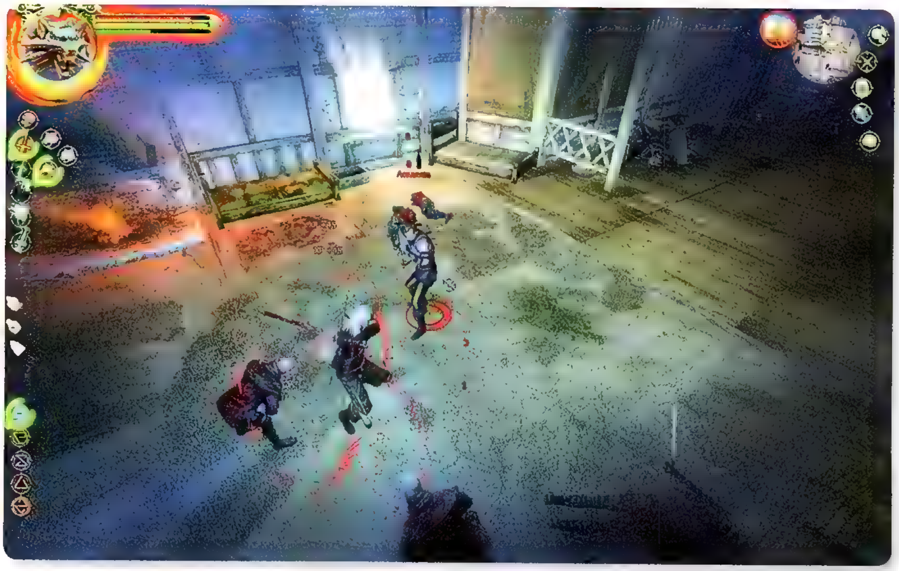
The Witcher, especially the Enhanced Edition, is one of the greatest RPGs ever made. It forgoes the cookie-cutter approach to RPGs (the likes of which Dragon Age exemplifies) and provides you, the hero, with choices that can sometimes have no best or right choice at all, just actions and consequences. This is one factor of its adult nature, as is the ability to get drunk, start fist fights, bed lots of women, and the language – which is strong enough to make even the hardiest biker blush.

But despite all the plusses, it's a bit of an easy game even on hard. The dynamic combat is fun, but not always challenging. And that's what Full Combat Rebalance addresses.

With FCR our hero, Geralt, can die easily if he's surrounded, and a greater emphasis has been placed on potions and oils (specific to creature types) in order to take down his foes. The mod loosely models combat off the descriptions in the novels on which the game is based, where Geralt is a natural swordsman the better of most humans, but for which monsters are a real challenge. Hence combat with guards and bandits can be swift and decisive, while fighting off a horde of Drowners takes a little more strategy.

In addition to redressing combat, FCR also includes a host of excellent changes such as an extended isometric camera, more quickslots for all armors, and an entirely new Sign called Heliotrop for those who prefer magic, and a range of bug fixes and enhancements to the original gameplay.

On its own The Witcher: Extended Edition is a game every RPG fan should have in their Steam list, but combined with FCR (and a few texture packs to bring the aging engine up to speed) it's easily one of the best games of the decade. As Geralt would say "A mercenary, a dwarf, and a troubadour that knows all the loose women in town. Who better for advice?"



FOOK2

Game Fallout 3
URL www.fookunity.com

The team behind this mod would very much like to FOOK you. And your game, if possible. But in a good way, and by good I mean adding over 150 new weapons (including 36 varieties of assault rifle alone!) with textures and sounds, as well as a re-working of the weapon damage and item stats system in Fallout 3. At least, this is how it started. It then branched out into placing new unique loot in the world, adding new weapons to NPC level lists, adding new armors, re-working the drug and chem effects system, updating the salvage and crafting system, adding destructible items, adding new visual effects, and finally improving the official DLCs. Which is why the download clocks in at a hefty 1.1GB.

Being one of the larger mods for Fallout 3 it naturally has both complementary and compatible mods that work well with it, as well as mods it will always conflict with. Currently, FOOK2 is considered the ultimate new weapon mod that dovetails nicely with Martigen's Mutant Mod (by yours truly), giving FOOKers a challenge and something decent to shoot at, while somewhat working with FWE (Fallout Wanders Edition, the premiere 'game balance' mod) with a special patch. But that's the joy of using mods – you can pick and choose the ones you want to use and, usually, someone somewhere has made a patch (actually a mod in itself) that helps glue some of the larger ones together.

As with many Fallout 3 mods, FOOK2 (itself a re-imagining of the original FOOK) is a work in progress, and the FOOK team is working on ironing out any remaining bugs while continuing to add new features. But this shouldn't stop you trying it out. It's only when you play Fallout 3 with mods like FOOK2 that you see just how empty the original Fallout 3 is. If you're still playing Fallout 3, or yet to play it, add FOOK2 as one of your must-have mods.

PATCH notes

The month's essential patches.

World of Warcraft Patch v3.3.2 to v3.3.3

DiRT 2 Patch v1.1

FIFA Manager 10: Client Update 4

Majesty 2 Patch v1.3.336

Warcraft 3 Patch v1.24e

Warcraft 3: The Frozen Throne Patch v1.24d to v1.24e

Dominions 3 Patch v3.24

Torchlight Patch v1.1.5

BioShock 2 Patch v1.0.0.2

Football Manager 2010 Patch v10.3.0

Borderlands Patch v1.30

Battlefield Bad Company 2

There's a truly great game in this sequel, but it might take some effort to find...

In creating a PC gaming experience for Modern Warfare 2 that was far less than what shooter fans expected, Infinity Ward really handed DICE an easy run with Battlefield Bad Company 2. All that the game needed on PC was a solid system of dedicated servers, and it would have had a slamdunk. The continuing cries from fans that they were ditching MW2 and waiting for BC2 should have hinted the importance of delivering, though...

And, in a way, DICE has seriously dropped the ball. Bad Company 2 brings a lot to the table, but the one thing that fans were hoping for the most – a solid online experience that built on the strengths of the PC platform – is not one of them.

On the upside...

It's easy to forget there's a singleplayer side to a lot of games these days, and for all that the original Bad Company was a surprise multiplayer hit, its single player was more or less fantastic. The same can be said of the sequel, too. It's got great writing, rooted firmly in the excellent characters, and it's a mess of fun. Sure, the plot itself does feel a little B movie, but we were always entertained.

It's much more linear than its predecessor too, and here's where the... let's call them interesting decisions start. In Bad Company – and we will be making lots of comparisons, as the changes are rather large – singleplayer maps simply felt like more scripted and focused versions of those in multiplayer. They were large, open, and when you died and curiously respawned we found that crossing them could be a chore.

In BC2, the annoying respawns away from your team have been replaced with more traditional level restarts, and the maps themselves are largely linear. There might be a choice of which door to enter in a building, but otherwise it's all very tightly mapped out. There's greater use of set pieces, too, heavily scripted events that make for a stronger narrative at the expense of freedom. No biggy, though – you'll get more than enough freedom in multiplayer, right?

But that's kind of a difficult straddling match: making an engine that can handle the close-in, character-driven MW2-style action that the Bad Company 2's single player offers, while also then being powerful enough to provide not only wide-open, vehicle-based gameplay.

And then of course, there's the destructible terrain. In single player it really only serves as a gimmick, usually to allow you to feel like one cold mofo as you blast away at a wall to nail the guy behind it, or blow up a building to take down a sniper. One early level – the first time you tangle with a tank – shows off the great flaw of this feature, and indeed the issue with the way the two game styles cross-over. It's the AI.

In short, if they can't see you, they don't shoot – which makes your knowledge of the terrain a huge advantage. Stray fire might chip away at your sandbag emplacement, but mostly you can duck clean out of sight. Your enemy isn't so lucky, so with ammo rarely an issue, you raze buildings with near impunity.

Good thing it's still fun, though. Sure, the more intimate setting also points out that the BC2 engine really isn't that impressive visually, but you'll forgive that when you manage to get into multiplayer.

And now the downside...

The multiplayer part of the game, when you get to enjoy it, is really something. The maps are large, the interaction between different classes (when you can convince your team not to all take Recon) simple but hard to master, the vehicles diverse... all that stuff you'd expect from a DICE game. But it's the fact that the actual server-side of the launch has been as screwed as any MMO that galls.

Problem one: some players – and we had this issue too – simply cannot get stay connected for more than five seconds before being kicked for Punkbuster issues. As of writing, it's been about four days and this has not been fixed at the server side of things, and instead requires players to manually delete and re-install the version of Punkbuster that installs with the game.

Then there are other issues, such as not even being able to browse games, or the fact that there's no option to host servers out of the box – only EA-approved server-hosts get that functionality. This is particularly nasty for Australian players, as with a limited choice of servers, getting a game during peak hours is tough.

But even when everything runs smoothly – there's an empty slot on a low-ping server, Punkbuster doesn't shit itself, etc – there's still DICE's agonisingly clunky UI and stats system to contend with.

Seriously, we've never had a game make us jump through quite so many hurdles – and some of them are broken! For instance, to get into multiplayer you've got to log in; the game offers to remember your details, but the login screen pops up regardless, and manages to get your details wrong most of the time. Each screen takes entire seconds to load, too; we do expect that from server refreshes, but not... for every... part of the... process. Even logging out is a chore, and if you want to quit the game when a match is finished you have to wait to get into the next round to do so... and then you have to wait while your stats update! Argh!

But the game itself... everything from the metallic echo of automatic weapons fire under a bridge to the way some objects seem to literally disintegrate under fire all adds to up to provide a truly unique experience. Sure, the game could use some balancing between weapons and classes (especially to stop everyone choosing Recon/sniper), but when everything comes together Bad Company 2 is more than capable of providing just about the best FPS action on PC today.

It's the surrounding systems – Punkbuster, server support, and the game's damn UI – that get in the way. There's a lot of noise in EA's forums about people waiting to buy the game, and we can understand that. But if you can have the patience now, look at it this way – you'll be ranked up and have all the best kit if you get the game now. **DH**

PC, PS3, Xbox 360 (reviewed on PC)

Developer EA Digital Illusions CE
Publisher Electronic Arts
Website www.battlefield.com/badcompany2/

Graphics Not as smooth as we'd like, but scope is impressive.	83
Gameplay Great gameplay – assuming you can get past the hurdles.	79
Sound Stellar gunfire, solid voicework	90

Overall
A mixed result out of the gate, but hopefully more work will mean more polish.

80%

Silent Hunter V

We rig for silent running and spend some quality time with a lot of seamen.

There's just something about submarine movies. The tension derived from anything set in a sub being the ultimate in locked box dramas is always palpable. Then there's the precise, stalking nature of submarine combat – whether it be low tech WW2 epics like Das Boot, or more modern classics like Crimson Tide, there's something unique about the war beneath the waves.

The Silent Hunter series has been exploring the lower tech side of this phenomena since 1996, though back then it was in the hands of strategy specialist SSI. These days, Silent Hunter is in the hands of Ubisoft Romania, but the classic sim remains remarkably true to the original while offering a lot of new gameplay options.

And, of course, the very unpopular DRM system that requires players to be online at all times, and that stores save-games offsite. It's not been a popular move – already server issues have caused downtimes and blocked players from accessing their saves. Many diehard fans have even refused to buy the game at all.

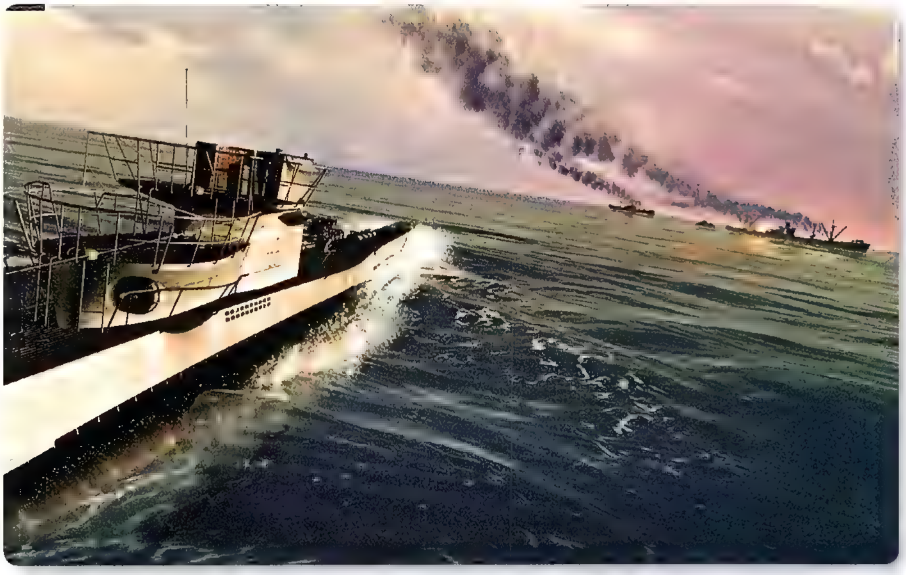
We've had no problems during our reviewing, however, and it's a shame that more people aren't going to pick this up – because it really does deserve some attention.

The men behind the man

Silent Hunter 5 offers both single and multiplayer action, and a full branching campaign to boot. The campaign kicks off very cinematically, as Germany declares war on Poland, and then Britain joins her ally against Germany. It also wears its inspiration on its sleeve – every second character seems to sound like Jurgen Prochnow in Das Boot!

After helping your Captain sink a few Polish merchants, you return to port – it's almost a tutorial 'level', but it's a very light one, and from here on in the learning curve increases. Back at port, your Captain is assigned to a new boat, and you get bumped up to command his old one.

For the first time in the game, much of the action is totally first person – you'll walk around dock talking to engineers to get your ship refitted or repaired, talk to officers to get new missions, and generally gawk at the scenery. It's the same on board, too; you can access every tiny compartment of your boat, talk with select crew members, and even use some of the stations. Previous games made you the ghostly commander of an empty ship, but SH5's subs are alive with cooks preparing meals, scowling first officers, and eager watchmen.



The effort to bring some life to the game goes even further in terms of crew management. Not only can you train each crewman in various passive and active abilities (like giving your torpedo officer the ability to 'overheat' his torps, or making the hydrophone operator better at picking out contacts), you can talk to them about various personal issues, like home life or how they rate your chances against the royal navy. Such interactions can boost – or potentially harm – crew morale.

They even get scared and need good leadership when things get tough; which they almost certainly will. The game gives you a great sense of being in command, and walking through the boat after securing from battlestations is a supremely immersive – and satisfying – experience.

That sinking feeling

Also impressive is getting a firsthand view of an actual engagement.

One a ship is sighted, it's time to put on your thinking cap – you need to consider the enemy course, confirm the presence of military vessels (a lot of your targets are merchant vessels), and then work out how best to approach your target without detection.

Even when you are in range, you've then got to judge when to fire off your very limited torpedos – it's easy to miss.

There are a range of realism levels you can set the game to; which will affect how hands on or hands off your experience is. It's entirely possible to play without really 'doing' anything. You simply give orders and things happen. And, to be honest, that's very realistic, and SH5 is just as good at making combat immersive. The vagaries of war mean that nothing's certain, so while you may get lucky with every torp strike, a few misses might mean you need to surface and use your deck gun; or perhaps the CO2 levels in the cabin mean you need to surface right in the middle of a pursuit – you'll need to carefully manoeuvre to avoid damaging hits, and might even be called on to man an AA gun to fight off annoying aircraft.

Your customised crew come into their own during battle, too, and again, the first person nature of the game really brings home the war. To get a crewman to use any active abilities, whether it's your bosun's skill at calming the crew, or asking your radarman to take a guess at enemy positions, you'll need to physically talk to them. Juggling this with actually tracking and engaging the enemy is frantic fun.

And when it all comes together, the satisfaction of seeing a flaming ship sink beneath the waves is immense. Each time you feel like you've earnt it.

Plus, the game's engine is marvellous – explosions, environmental effects like clouds and fog log better than any other game. But the star of the graphics side of things are the water effects, which depict the most realistic waves we've seen in any game to date.

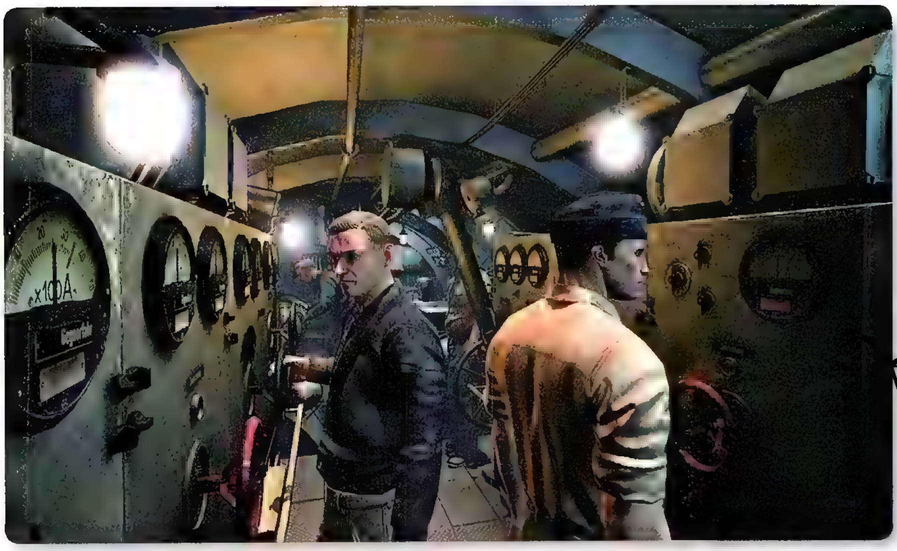
There's always a but...

But... there's that DRM issue, which every time you start up reminds you that you really are at the mercy of Ubisoft and its server engineers. Or the quality of your connection.

On top of that, long sessions can end up with slowed framerates, and in our case at least, crashes and complete lock-ups. With such a detailed engine on top of a lot of variables to track (weather, multiple ship movements etc), the game really pushed our test rig at times.

But when all is said and done, the crashes are rare, and we always felt absolutely compelled to get straight back into the game. It is slow paced at times, but a sub sim should be. And for sheer tension, the game just cannot be beat.

In other words, it's title worth surfacing for. **DH**



PC

Developer Ubisoft Romania
Publisher Ubisoft
Website http://silent-hunter.uk.ubi.com/

Graphics Great weather simulation, and night-time explosions look way pretty.	90
Gameplay Can be buggy, DRM issues, very tense otherwise.	80
Sound So many dodgy German accents, but good effects.	79

Overall
A taut thriller of a game, despite some flaws.
83%

Command & Conquer 4: Tiberium Twilight

Like a pot of instant noodles without the flavour packet.

The C&C series has chronicled the timeline of an epic fifteen year struggle between the forces of the Global Defense Initiative (GDI) and the Brotherhood of Nod (NOD) across multiple instalments. From its original 2D standpoint to more recent 3D flavours, the series has maintained a cheesy, light-hearted storyline backed up by some serious acting skills and furiously balanced gameplay. Millions of bases have been constructed since the series' inception, and billions of tonnes of Tiberium harvested to fuel the two warring factions. Unfortunately for fans of the series, this legacy has been cut off at the shoulders – for better or worse.

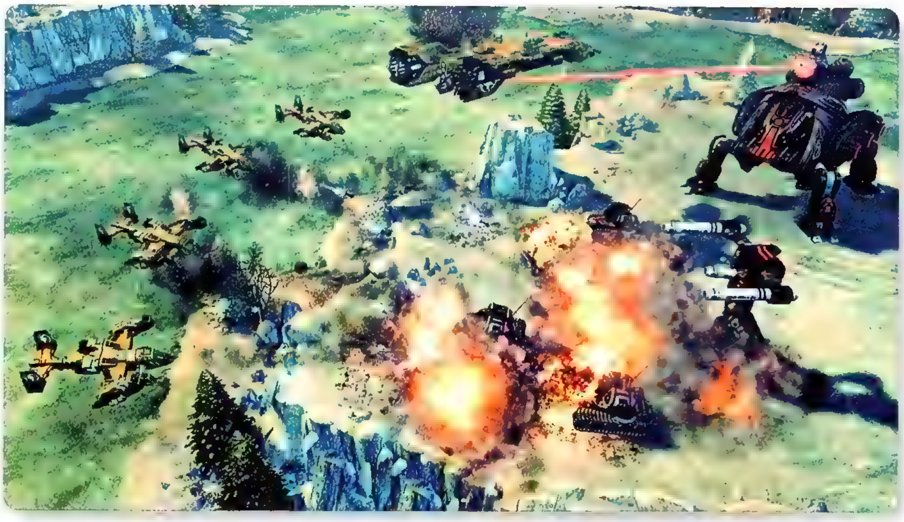
You can't kill the messiah

C&C4 kicks off with his holiness himself, Kane, in cahoots with GDI. Set some fifteen years after the events of C&C3, the Scrin are nowhere to be found. Tiberium is still the world's primary power source, but it's running rampant in most areas that aren't in large cities – which is the only explanation offered as to why GDI and Kane are bestest pals ever (strange, considering they've done nothing but feud against each other). Indeed, Kane comes off as a declawed and soggy kitten in the full-motion video clips between missions, and while his badassery begins to somewhat return later when he betrays his newfound allies, our impressions of the singleplayer campaign aren't astounding.

It doesn't help, either, that you've got to log in and have a constant connection to the net just to play the game – yes there are some slight benefits to this as we've highlighted online (**www.atomicmpc.com.au/?169768**), but they're simply not worth the hassle to be justified. Even the Tib itself has changed, with the need for an economy completely thrown out in favour of a unit cap-based setup that comes with *major* flaws.

Our directives must be reassessed

Gone is the iconic Mobile Command Vehicle that has defined the series until this point; replaced with a lumbering behemoth called the Crawler. The removal of the Scrin force has been somewhat plugged up with the addition of three classes for both NOD and GDI; covering Offense, Defence and Support. These ill-contrived classes restrict you to ground-based units with powerful attacks, ground-based with average attacks and some defensive stat benefits, and air-based units with weaker attacks and plenty of powers – each giving a comprehensively different playing style. In multiplayer this works impressively well, creating a thoroughly unique dynamic in matches that should ensure that no two games are the same.



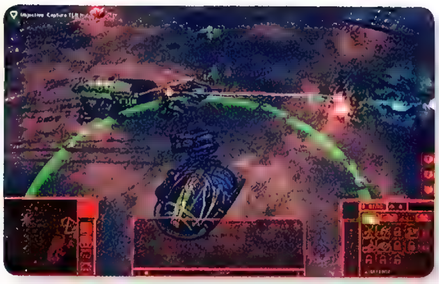
However, this mechanic cripples the singleplayer game. This was highlighted every time we were feeling adventurous and chose anything other than Offense; where our forces simply weren't numerous enough to contend with the AI. To make matters worse, the standard multiplayer unit cap of 90 was arbitrarily slashed to only 50 in some cases, and the AI had access to a frankly stupid collection of *four* Crawlers with the full amount of units and plenty of artillery platforms to boot. While it's more than possible to defeat each alone with plenty of Engineers to repair your forces, when they gang up against your teensy force it can be hard to have a fair fight – and any fun at all.

The complete lack of any base building whatsoever, save for defensive turrets if you play as the Defence class, means that you'll be cast adrift in most levels without much guidance as to where to head. There are typically multiple starting points where you can call down your Crawler, and multiple objectives, but no clear explanation of what the requirements are for completion nor the reward you'll get for doing so. Achievements are thrown in as the token 'every game has them hyuk-hyuk' inclusion, and they're neat to get, but ultimately don't give you enough XP to actively pursue.

Thankfully there are some moments in the singleplayer campaign that are suitably epic, with large battles mixed with interesting terrain and clever map design. After three missions of quick tutorial, you can choose your preferred side and complete their story. Each mission completed for each side gives you experience points, which in turn grants you additional 'levels' and access to more powerful units. This does give you a slight sense of accomplishment as you progress through the campaign, but it also means that you'll be grinding harder than a WoW-head through skirmish rounds to get the actually decent units if you want to play competitively.

GDI could use a good soldier like you

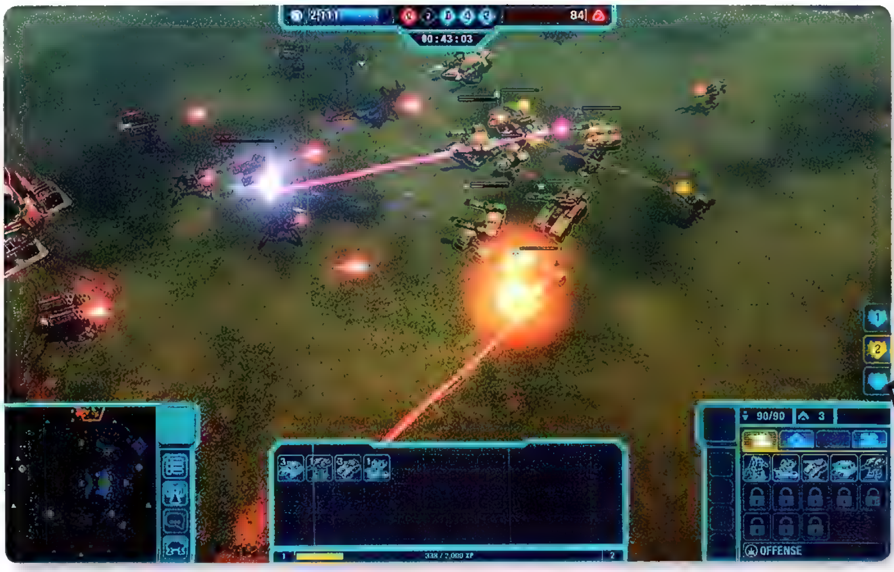
The campaigns are depressingly short, and they detail the disappointing end of Kane's inclusion in the C&C series. Of the other actors in the cast there are none that are particularly memorable or enjoyable; a far cry from C&C3's inclusion of Michael Ironside, Grace Park or Billy Dee Williams (*Lando!*). Some cutscenes even have your in-game wife nagging you – "It's just that... I miss you when you're on duty" – which feels forced and somewhat useless in the C&C universe. There is one Jim Carrey look-alike on NOD's side, but even he isn't enough to make much of a splash.



Another unwanted slap in the face was the Sage-descended RNA engine's framerate limit of 30fps regardless of vSync settings, meaning that no matter how powerful your rig is you'll never be able to generate a genuinely silky-smooth image. While 30fps is in no way terrible, it's still a remnant of the console era that shouldn't inflict itself on PC gamers.

Do the right thing, Commander

For a series like this, it's a huge shame that it is ending on such a poor note. The gameplay elements feel borrowed from games like Dawn of War II and RPG titles, as if including them would make this game twice as fun as either of those genres, but instead results in a confused mishmash of a campaign that has no charm or lasting appeal. Multiplayer can provide a pleasant and sometimes refreshing experience, but not consistently, and the always-watching internet connectivity bodes poorly for freedom in gaming. In all, C&C4 has left a bitter and unpleasant taste in our mouths; one that we suggest you steer clear of. **JR**



PC

Developer EA Los Angeles
Publisher Electronic arts
Website www.commandandconquer.com

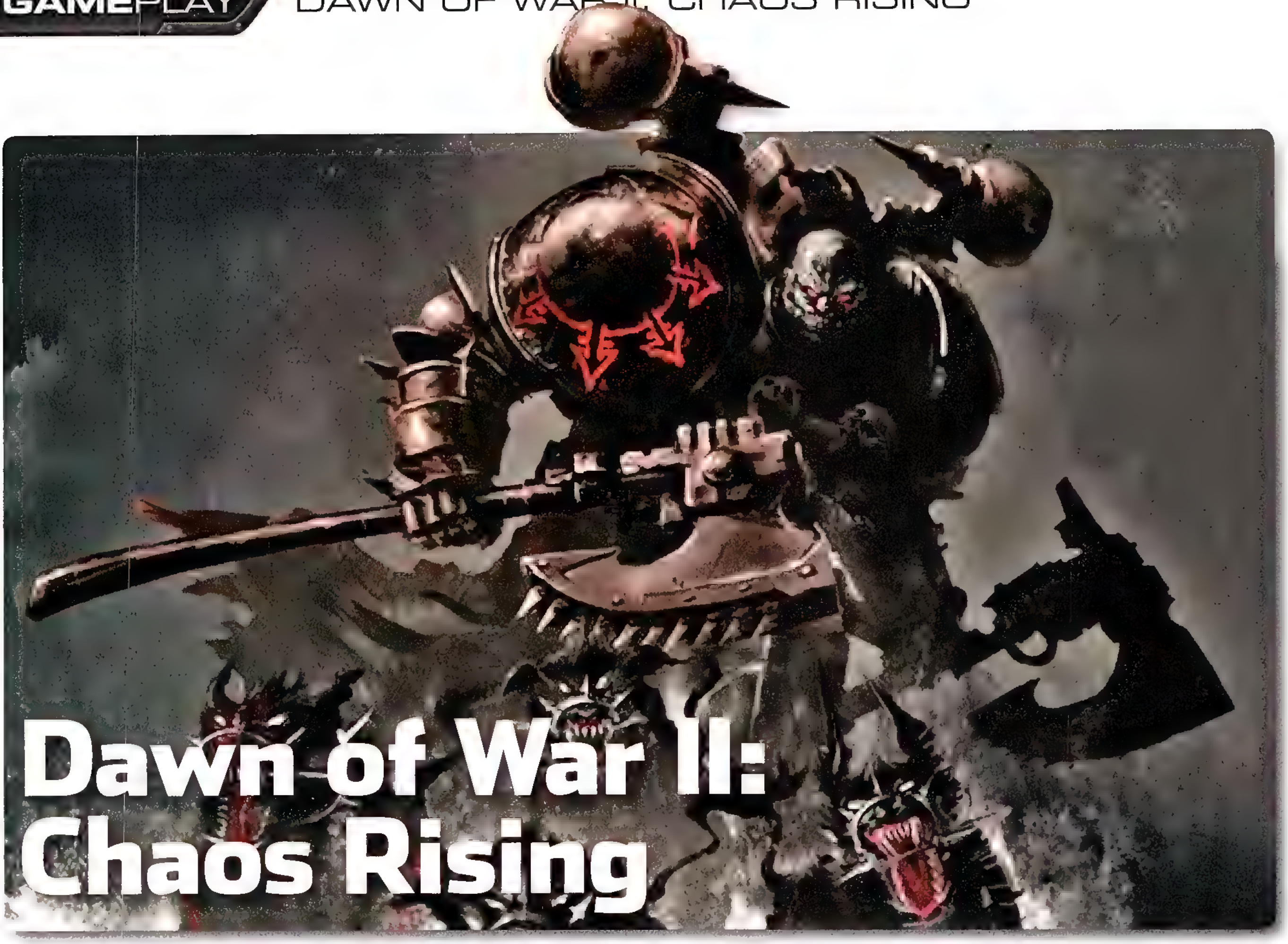
Graphics 75
Same old SAGE engine, same old limits.

Gameplay 40
Tiny chunks of fun in a sea of fail.

Sound 85
Soundtrack is nice, otherwise good.

Overall
A game that had everything to lose; and gambled it all away.

50%



Dawn of War II: Chaos Rising

More power armour, more big guns, and more evil...

Relic looks to be following the same expansion model for Dawn of War II as the company did for the first game in the series: release an expansion, with a new race and new campaign, add new units to the existing multiplayer rosters, and make all of it standalone – you don't have to own Dawn of War II to play Chaos Reigns. It's a good model, and Chaos Reigns is another reminder of just how in-depth Relic's knowledge and commitment to the universe of Warhammer 40,000 is.

But, it might just be showing some signs that the franchise is getting a little long in the tooth.

The infernal powers

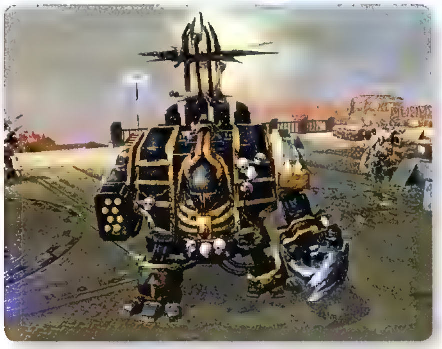
The new race getting added to the Dawn of War II pantheon is... Chaos. Not surprising, really, given the game's name, but it certainly is good to see the antithesis of the noble Space Marines make their return.

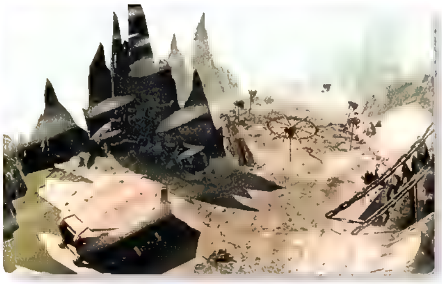
The game takes place after the action of the first one, and it's even possible to transfer over your squads – complete with weapons and unit upgrades – from the old campaign to this new one. Alternately, you can choose to simply start with your squads as they are, at level 17. Either way, the first few missions will drop enough gear on you that your most epic possessions start looking ancient real fast.

Within the first few missions you'll be re-introduced to all the old characters, and even a new one – the mighty Librarian Jonah Orion. And when you hear 'librarian' don't for a minute think meek, dusty old men... Marine Librarians are warriors in their own right, and wield incredible psychic powers to boot.

The game takes place on the same planets as the original, but in addition there's also two new ones that bring a whole new look and feel. There's the snowy Aurelia, the old sector capital, and planet that only recently reappeared from the Warp, and the space hulk Judgement of Carrion. These give a lot more variation than the original release, and there are more varied missions to boot – which stops the end-game becoming a slog of one well-worn map after another.

Along with Chaos, all the races from the original title return to the campaign. The Eldar are up to mysterious shenanigans, Orks just like a fight, and





there's even Tyranids in some thrilling space-hulk-based missions. There's a competent story linking each mission together, but let's be honest – this is all about blowing stuff up in the name of the Immortal Emperor of Mankind.

Chaos makes for a great opponent, and most of the Gods from the tabletop game are represented here to stunning (and sometimes really, really gross) effect. There's bloodthirsty Khorne, the mutable Tzeentch, and the plague-ridden Nurgle.

Annoyingly, the one God that's missing is Slaanesh – but given its worshippers are mostly known for nasty sex and letting their breasts hang out... we can understand why Relic might be happier just ignoring them.

All that said, though, while being standalone might make this feel more like a sequel, and the campaign content leans that way too, it is just DoW2 with some new stuff tacked on. The gameplay has not really changed in any way, and the single player can at times feel a touch samey – stripping the base-building and all that entailed from the game was a solid move, but it also takes some of the juicier ways to define a race or faction out of the equation.

What's more, the one really new gameplay mechanic, which is meant to represent the corrupting influence of Chaos, really doesn't deliver. Effectively, Relic's introduced a form of morality measure into the game. Certain conditions and choices will swing you toward the Chaos Gods, and certain equipment can do likewise – this is juicy stuff, and very appropriate for the setting, but it doesn't seem all that balanced. There's just not quite enough reason to stay loyal; the rewards for purity don't equal the rewards for betraying humanity. Of course, we'd never fall to the Dark Gods, no matter how great the rewards – Atomic is an entirely loyalist publication.

The game also feels a lot harder, too. Given the deep lore of both the 40k universe, and the backstory built up in the DoWII, new players could easily feel both overmatched and quite lost. Even we found some missions to be a real challenge. Tough missions are all well and good, but when it leads to you simply watching health bars and power cooldowns rather than the incredible action you're controlling, it seems a little empty.

Then there's multiplayer, which, like Chaos Rising's single player campaign, is much like the original. This isn't a bad thing, but again, because a lot of the game feels more sequel-like, you get this odd sensation that things are a little too like the original release. The new maps are certainly welcome, however, and Chaos offers even more variation. It's still good, don't get us wrong, but playing competitive 40k online is always an odd experience for people who play it on the tabletop.

Relic knows its stuff, though, and when you look at all that you get in the expansion, it's hard not to be impressed with the package. Dawn of War II remains a unique combination of tight strategy, RPG-like loot gathering and advancement, and incredible devotion to the source material. **DH**

PC

Developer Relic
Publisher THQ
Website www.dawnofwar2.com/

Graphics	A touch aged, but still suitably epic.	80
Gameplay	Still very good, and very true to the source.	89
Sound	The dark future of humanity never sounded so good.	85
Overall	Cleansing heretics: fun, and good for the future of humanity.	86%

Counterpoint: DRM

A reader responds to the challenge of DRM in games, and we like what he has to say.

Having read (and re-read) the Special Feature on copy protection in the April edition by Seamus Byrne I find myself disagreeing with the entire premise of the article.

Since Modern Warfare 2 was mentioned as an example of a heavily pirated game, I'll use it as a counter-example: I bought it and I got screwed.

This was one of the few games I decided not to 'sample' prior to purchase on the basis that I really, really enjoyed Call of Duty, Call of Duty: United Offensive, Call of Duty 2, Call of Duty: Modern Warfare and Call of Duty: World at War. All up, I've spent thousands of hours playing these games and they've been well worth the money I spent buying them. With such an impressive lineage, I figured I'd just pick up a copy of MW2 and game away happily until MW3 comes out.

Unfortunately, I have to use a WiFi connection between my gaming box and my router and before you start laughing, it works fine for everything else including COD4 and WaW. As soon as I was matched up with some random players and got past the IW lobby, MW2 decided that I'm the best person to host the game. For some (blatantly obvious) reason I started lagging for three seconds every minute or so while some backend server code did its thing and I began getting showered with abuse by all the other players – "You suck host", "GTFO you tard", "host quit the game you laggy fuck".

Since there isn't a simple way to disable being the host, and since I'll just end up abusing another laggy host myself because MW2 isn't smart enough to weed out the players who shouldn't be given the responsibility of hosting the game, I've basically done my dough and I'm back playing COD4. I *should* have pirated MW2. I'm still kicking myself that I didn't 'try it out' with a cracked version via torrent first and I bet a lot of the suckers... er, customers who "did the right thing" and bought it are too. The poor sods who bought Assassin's Creed 2 are probably thinking the same thing, considering the monumentally screwed up mess that release was. Yeah, 'Permanent Connection Required' was a REALLY smart idea. I wonder who it was who forgot that that there are TWO ends involved in a connection and why they assumed their end would be bullet-proof?

The rest of your article seems to just run through the usual talking points about piracy (a pirated copy isn't necessarily a lost sale... but!) without seriously considering the things that developers and publishers should be considering when they compare consoles to the PC. Can I rent a console title to see if it sucks? Yes, I can. Can I rent the same title for PC? No, I can't. Why? Because I might pirate the disc. Did someone forget we use the internet for getting pirated copies now? Obviously. Ever try returning a faulty PC game? Good luck mate. People who illegally sample the PC version are pirates, but people who legitimately sample the console version are good customers of the local DVD store. All praise the console owners, for their sampling is recorded on the favorable side of the ledger!

Oh, and the pirating stats doubled between 08 and 09 did they? Well, leaving aside the fact that TorrentFreak's ability to gather statistics from a wider variety of sources increased significantly over that period, is it perhaps worth mentioning that people are wising up to how catastrophically DRM can fail on their newly purchased (and often unusable) games? Spore was mentioned specifically as an example of why some people think "piracy is excusable", so why would someone suffer Spore's DRM and then NOT pirate their next intended purchase first? If Will Write can bork it up that badly...

I'm still kicking myself that I didn't 'try it out' with a cracked version via torrent first...

I may show up in the TorrentFreak stats as a pirate, but I also show up in the retailer's stats as a legitimate customer and nobody is making a serious effort to acknowledge that relationship. Maybe it's just too hard to get reliable data on pirates who becwome customers or maybe it's just too easy to look at the number of downloads and multiply it by the cost of a legitimate purchase and then have a cry at the eleventy billion dollars in lost profits all the kids are depriving publishers of. I don't know, it's not my business to sell games and I don't have millions of dollars to throw at properly researching the market like the publishers have (but don't seem to bother doing), although I can say from personal experience that offering to legitimise a pirate install does work and it does provide useful data on conversion rates.

I actually work at a company that generates most of its revenue from IT related intellectual property. We don't care how many copies are being used, we care about how many copies we sell. We offer a 'patch over' discount for people who want to legitimise their pirated copies and we throw in a checksum validation of the app they're running and do a byte-for-byte verify and replacement of any unofficial/malicious code that shouldn't be there. Two of our devs actually make more money from the shareware programs they wrote back in the 90s than they do working for us. For some strange reason, we still make good money but there always seems to be plenty of people who try to explain to us why (a) the video game industry is completely different to ours (and that market forces like "not releasing lame, buggy product" don't apply to them) and (b) that our business model is unsound and we'll go out of business any day now (despite having been around for just over eight years and having enough cash in the bank to give the entire company a paid, year-long vacation if we felt like it).

Forget 'carrot and stick' measures, how about just more friggin' carrot because I can just as easily go play something else if your game doesn't make it past the load screen or dumps some nasty code on my very expensive PC. I'm actually surprised how disappointed I was with that article because the whole thing just led to the (inevitable) conclusion that we shouldn't be naughty pirates because the poor publishers will starve and there won't be any cake next time we want to play something fun. Yeah? Well, the cake is a lie. Frankly, I wouldn't miss any games (and DRM) that the devs and their publishers are too lazy to get working properly on the PC. I'll be happy to avoid the maze of broken code and broken promises that go with being a PC gamer these days so they can bugger off and play in console-land for all I care.

Alex

We often get a lot of Feedback on our forum and via email, but occasionally we get something we think is worth turning around and actually publishing – and this wonderful response to our article inspired by Ubisoft's recent DRM headaches (more on that at our site) is pretty much bang on.
We have to admit... we're kind of sold on Alex's reasoning.

MOVIE REVIEW

How to Train Your Dragon

Another visually fantastic rollercoaster from DreamWorks.

Directors Dean DeBlois, Chris Sanders
Starring Jay Baruchel, Gerard Butler, America Ferrera

DreamWorks Animation are well-renowned for creating great movies for kids and adults alike; you've only got to watch *Shrek* or *Monsters vs. Aliens* to see stunning examples of their previous work. However, How to Train Your Dragon (HTTYD) is a new level of awesomeness – both technologically, and visually.

As we saw in a presentation at the Intel booth during CES this year, DreamWorks have partnered up with Intel to power their 3D moviemaking. What this entails is a gigantic server cluster, called a 'render farm', absolutely stuffed to the hilt with Intel's speedy Nehalem-based Xeon processors. The four core, eight thread chips provide a processing powerhouse that completely trumps what they had to work with in previous years – and this hugely increased amount of power shows through in every part of HTTYD.

The film revolves around the antics of Hiccup, an unfortunately-named viking with as much muscle as a banana peel who lives in a village plagued by dragons. These gigantic winged pests are certainly a problem, but they're also breathtakingly detailed in a way that cinema hasn't shown before. Each species has intricate spikes, teeth, and horns dotting their surface, with veiny (slightly transparent) wings and quite literally thousands of articulation points along each one of their joints. Unachievable until now, the artists who worked on the film had enough power to animate the models in real-time, before a final render of the film with the full level of detail.

This results in very believable dragons, with up to thousands on-screen at a time, all rendered to huge detail and effect. The extra horsepower also sees use in the backgrounds and scenery; the water effects are unlike anything we've ever seen, as masterfully similar to real water that you'd be forgiven for thinking it *was* real. To top this technical achievement off, it's rendered using the RealD 3D system (as explained on page 10) which demands each frame be rendered twice!

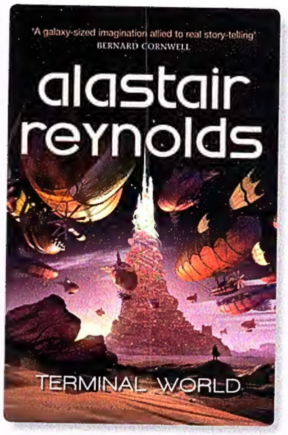
This film is a great showcase of DreamWorks' technical prowess, but the story is more than compelling enough on its own; with hair-raising thrills matched superbly by off-handed humour and quirky one-liners from the zany viking cast. While it might not break new ground in storytelling, it's more than worthy of a watch – and it's good enough that we're seriously tempted to re-watch it only a week later. **JR**

Overall
A roaring showcase of tech, excitement and humour.
91%

BOOK REVIEW

Terminal World

There's twists and turns in Alastair Reynolds' latest, but it's not quite up to his usual quality.



If you've never read anything by Alastair Reynolds, and you're a sci-fi fan, you're doing yourself a massive disservice. From his incredibly well-paced and epic Revelation Space series, to his impressively emotional one-offs, to his tight shorty-story collections, Reynolds is one of the modern masters of space opera. But, that being the case, if you've never read any of Reynolds' work, starting with Terminal World is probably not the best idea.

It's not that it's bad, but it's certainly not Reynolds' best work to date. The novel is about a supposed future Earth, one where some vast catastrophe has not only left a lot of the world uninhabited, but also prone to technology inhibiting 'zones'. As one moves across zones, different levels of technology fail or start to work, leaving the Earth and the impressively realised city of the Spire, where the novel starts, split up into distinct cultural regions.

But something's coming which is going to change everything, and whoever controls the most tech will likely come out on top. This is where the main character, a literal fallen angel comes in – he's undercover, a denizen of one of the highest tech regions in the Spire, and on the run from mysterious killers.

Along the way there are carnivorous cyborgs, bloodthirsty raiders, and a nation made up entirely of dirigibles. So, really, can anything with dirigibles, and dirigible-on-dirigible battles, ever really be bad? Well, yeah.

The main issue is that it lacks the sweep of his earlier works, even the standalones like Pushing Ice and House of Suns, while also lacking the strong characters that made Revelation Space such a, well, revelation. In fact, it reads much more like an expanded short story or novella than a full length novel. There's no real emotional center to the story, never someone that you really like enough to care about. The final few pages do deliver bit of a kick, and it's a satisfying read, but if this were a reader's first foray into Reynolds they could be forgiven for thinking his popularity (and he's just signed a mighty ten book deal with his publisher for a mess of money) is mere hype without substance.

And that would be a shame – Reynolds is an exciting writer. If you're a fan, Terminal World is certainly interesting, but it simply doesn't live up to what's come before. Hopefully, this is just a blip, and not a sign that the new writing deal is going to push Reynolds' to drop his quality to deliver quantity. **DH**

Overall
Not the author's best work, but still entertaining.
71%

The game that killed a company

There's no sadder tale of demise than that of MicroProse, nor one of triumphant achievement. **Ben Mansill** turns the Wayback Knob to M.

Between 1982 and 2001, MicroProse played the leading role in shaping PC gaming. The cultural legacy of its games carries through to today, helping define what it is exactly that makes one a PC gamer. Despite nearly dominating the PC gaming charts for almost 20 years, MicroProse held to heart a laudable attitude that's tough to identify today in the majority of games developers and publishers.

For most of its almost 20 year history you could reliably buy a new MicroProse game off the shelf knowing nothing about it, with the back of box impression seemingly at odds with one's personal tastes, but arrive home to discover a game you'd fall instantly in love with. The company could do no wrong, with a seemingly endless stream of games that were responsible for hooking in so many of today's gamers, many of whom still hope there will one day be another company that evokes the same affection for gaming.

Although we didn't know it, or bother thinking about it at the time, a new MicroProse game back then stands a pretty good chance of appearing in somebody's Greatest Games of All Time list today. Witness: *Civilization 1 and 2, Colonization, Geoff Crammond's Grand Prix 1 - 4, Falcon 4.0, Gunship 2000, Master of Orion 1 and 2, Master of Magic, Sid Meier's Railroad Tycoon, Sid Meier's Pirates, Silent Service 1 and 2, European Air War, Transport Tycoon, the X-Com games, Worms 2, F-117A Stealth Fighter, F-15 Strike Eagle 1 - 3, B-17 Flying Fortress*... and on and on.

The pressure to stay on top meant an ever growing team of developers, which included several smaller studios

Although best known as a strategy and simulation developer, MicroProse constantly innovated and diversified, creating and defining genres which continue to influence today. Some would say that the magic feel a MicroProse game had is sadly absent from most modern releases.

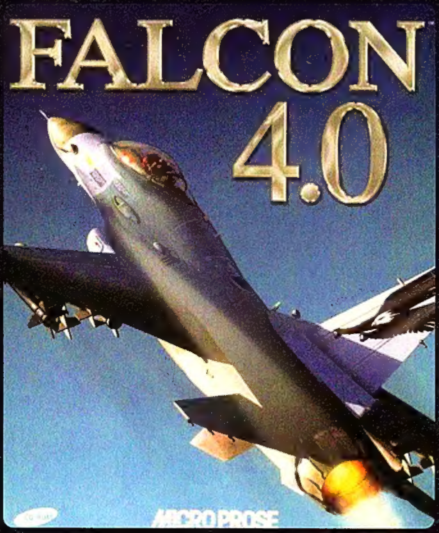
There was a quality and charm to a MicroProse game, an inviting escape and virtually guaranteed superior gaming experience. These were also games that defined PC gaming during its growth, and separated them from console gaming stylistically. These were clever, thoughtful games clearly designed by passionate geniuses. You could feel the love through your screen.

MicroProse seemed unassailable. The magic train of amazing games was as sure a thing as anything could be. Alas, death came via an unfortunate combination of external meddling and corporate shenanigans, which also led to key staff departing, all triggered by the failure of just a single game –one that wasn't even a MicroProse title to begin with.

In the early 90s MicroProse was riding high. Too high, in hindsight. The pressure to stay on top meant an ever growing team of developers, which included several smaller studios MicroProse had purchased. Costs were increasing faster than revenues and some level headed consolidation was needed to balance things. That should have been relatively straightforward and painless, but the first mis-step here turned out to be one on an irreversible road to ruin.

Instead of turning to the banks for capital, MicroProse founder Bill Stealey – who had led the passion-driven expansion phase with his wonderful attitude to great gaming – was talked into selling the company in its entirety to Spectrum Holobyte. That company was also riding high and flush with cash at the time, off the back of the mighty Falcon 3.0, king of the flight sims. Spectrum's CEO, Gilman Louie, was a mate of Bill's, so it's easy to see why they forged together. Similar passions and a hot run of winners.

Spectrum Holobyte was a year away from releasing the hugely anticipated Falcon 4.0, though dangerously, had almost nothing else in development. Everything seemed golden for the new company. As it turned out, Falcon 4.0 was a mountainously ambitious title that ended up being delayed until 1998, syphoning the new company's coffers along the way. When Falcon 4.0 was eventually released so much had been invested in it that the future of both MicroProse and Spectrum Holobyte were entirely dependent on it being a massive hit. It wasn't. Buggy and flawed, it sold dismally, sinking Spectrum Holobyte and leaving MicroProse unable to sustain operations. With a sprawling base of hundreds of developers and acquired studios to feed, the company was now vulnerable to opportunistic takeover.



Disillusioned with the emerging hardcore management style, star developer Sid Meier split to found Firaxis, taking Brian Reynolds with him. A bevy of others departed, joining Psygnosis. Starved of talent and with revenue well short of costs, MicroProse was ripe pickings for a bargain takeover. In stepped GT Interactive with a surprisingly rich takeover offer of $250 million. At the 11th hour GT changed its mind and as a result MicroProse's stock price fell through the floor. Staff were laid off, studios were closed in an attempt to keep its head above water. Hasbro entered the game and bought what was left (several hundred developers still worked for MicroProse) for $70 million, only to be taken over themselves 2 years later by French giant Infogrames, which immediately took drastic action, shutting down the MicroProse brand once and for all and spreading assets through its own company.

For close to 20 years MicroProse defined and cultivated PC gaming. Its influence is still felt today, though sadly, the lesson learned for today's publishers is less how things should be done, and more what not to do.

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